User's Manual

Diskeeper® Home for Windows®

Enhancing File System Performance – *Automatically.*

March 2007

This document describes the installation and operation of Diskeeper Corporation's Diskeeper Home for Microsoft® Windows. It is intended primarily for home users.

Revision/Update Information:	This is a revised manual
Software Versions:	Diskeeper 2007 Home
Operating Systems:	Windows Vista™ Home Basic, Home Premium, and Ultimate editions Windows XP (all editions except for x64 platforms) Windows 2000 Professional (Service Pack 3 and higher only)

Diskeeper Corporation, Burbank, California, USA

March 2007

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Preface

What This Book is About

Welcome to the Diskeeper User's Manual. We realize software manuals tend to be one of the least-favorite pieces of reading material around, so we intend to make this one as painless as possible. This book will first help you get Diskeeper quickly installed and running. Next, it describes the various Diskeeper features and how to use them. Finally, it defines disk fragmentation and how it affects your Windows systems.

Structure of This Book

- Chapter 1 describes how to install Diskeeper.
- Chapter 2 explains how to start using Diskeeper and how Diskeeper is improving your system performance.
- Chapter 3 gives a brief overview of Diskeeper.
- Chapter 4 explains the various features of Diskeeper in detail.
- Chapter 5 presents the theory of Diskeeper operation.
- Appendix A has tables showing the different Diskeeper editions, and the operating systems, features and capacities they support.
- Appendix B provides answers to frequently asked questions.
- Appendix C explains how to contact your Diskeeper Corporation Customer Service Representative for Support Services.
- The Glossary provides definitions of technical terms used in this manual.

Introduction

As in earlier versions, Diskeeper 2007 is designed to solve fragmentation problems for everyone, from home users to the world's largest IT departments.

This User's Manual describes the operation of Diskeeper Home edition. The Diskeeper family of products also includes:

- ***Diskeeper Professional***
- ***Diskeeper Pro Premier***
- ***Diskeeper Server***
- ***Diskeeper EnterpriseServer***
- ***Diskeeper Administrator***

Diskeeper Home edition incorporates simplified controls, and does not support the network defragmentation capabilities available in the other Diskeeper editions.

See *Appendix A* for tables showing all the Diskeeper editions with the features and operating system versions they support.

About Fragmentation

As used in this manual, the term *disk fragmentation* means two things:

- a condition in which pieces of individual files on a disk volume are not contiguous, but rather are broken up and scattered around the disk; and
- a condition in which the free space on a disk volume consists of little pieces of space here and there rather than a few large free spaces.

The effects of excessive fragmentation are twofold as well:

- file access takes longer because a file must be collected in pieces here and there, requiring several disk accesses instead of just one; and
- file creations take longer because space for the file must be allocated in little pieces here and there instead of just one contiguous allocation.

The bottom line—fragmentation slows Windows system performance. The longer you wait to defragment your disk volumes, the slower your computer runs.

With Diskeeper, all the volumes in a Windows operating system can be kept defragmented indefinitely. Diskeeper cleans them up and keeps them that way. This includes volumes with compressed, encrypted and sparse files on NTFS volumes.

Running either invisibly as a background process or as a manual defragmenter, Diskeeper carefully rearranges files and free space on a disk volume so they consist of as few pieces as possible. Diskeeper runs when other processes are active on the computer, so there is no need to lock users off a disk while it is being defragmented. The end result: Your computer will run faster when Diskeeper is enabled.

What's New in Diskeeper 2007

The term *Paradigm Shift* is somewhat overused when describing technical breakthroughs, but Diskeeper 2007 does indeed represent a major shift in the way you will improve the performance and reliability of your computers. For over a decade, Diskeeper has led the way in Windows system defragmentation technology, but Diskeeper 2007 takes such a significant step forward that *paradigm shift* is truly the most appropriate term to describe it.

Whether you've used Diskeeper before or not, you may already be familiar with some of its features, but Diskeeper 2007 represents a major milestone in the progression of Diskeeper development. New users will find Diskeeper to be easy to use, yet comprehensive in its capabilities. Experienced Diskeeper users will see major changes, yet still recognize familiar features, presented in a new, more streamlined way. This list gives a summary of what's new in this version.

- **Automatic Defragmentation**

  Diskeeper has made its reputation with the trademarked phrase "Set It and Forget It®," meaning that once Diskeeper is installed, you can simply forget about it. Defragmentation was taken care of automatically and your computer was kept at peak performance all the time.

  However, times have changed. Disk drives have grown huge. And, with the growth of disk drives has come an explosion in the size and number of files stored on disk drives. With terabyte drives (a trillion bytes) now easily available and smaller drives selling for very little money, you can store a LOT of stuff—practically everything. And file sizes are continuing to increase as well. Documents with embedded graphics, large presentations, scanned images, digital photos, MP3 music files and even whole TV shows and movies are now residing on hard drives. The vast quantities of these and their inordinate size present new challenges for computer performance and make defragmentation more critical than ever.

  As disks have grown bigger and files have grown larger and more numerous, defragmentation is required more and more often to maintain a computer's performance. While it used to be sufficient to defragment

once a week, it eventually became necessary to defragment daily. Today, even daily defragmentation is not enough. An hour's production activity can seriously degrade performance.

But scheduling a defragmenter to run every hour is scary to performance-conscious System Administrators and computer users. Even with features like I/O Smart™ and selectable run priorities, they are reluctant to run a defragmenter in the middle of the workday.

The answer is our new InvisiTasking™ technology. InvisiTasking uses a proprietary technique developed in our research lab to carefully monitor resource consumption on a Windows computer system and inject Diskeeper processing into the unused portions—and *only* into the unused portions. InvisiTasking is so good that it is all but impossible to even detect whether Diskeeper is running. That means Diskeeper can run all the time. It never needs to back off or shut down to reduce overhead, since overhead is already virtually non-existent! This means no more need for scheduling defragmentation. In fact, scheduling defragmentation *worsens* performance by delaying the improvement that defragmentation brings. Diskeeper with InvisiTasking means a computer performs at peak *all the time, around the clock*, not just for a few minutes after each scheduled defragmentation run.

The Dashboard tab in the Diskeeper display includes a real-time graph showing the idle resources on your computer, and the small portion of those unused idle resources used by Diskeeper with InvisiTasking. (Note that the graph also shows resources used when Diskeeper is run manually.) Now, you may be skeptical at first and find it hard to believe InvisiTasking has virtually no impact on system overhead. For this reason, you can specify times when Diskeeper is prevented from running at all. Eventually, we are sure you'll be convinced, and lock-out scheduling will be forgotten. The scheduling era is over, and the era of truly automatic defragmentation has begun.

- **Improved User Interface**

  The Diskeeper console has been enhanced to reduce the number of steps necessary to perform typical tasks, and to improve the overall user experience. This includes a new, easy-to-use "timeline" control for specifying the times when Automatic Defragmentation is turned on and off.

Chapter 1

Diskeeper Installation

This chapter provides information you need before, during, and after installing Diskeeper.

Before the Installation

Windows Versions and Platforms Supported

Diskeeper Home runs on the Intel® x86 platform (including Pentium™ and compatible CPUs from other manufacturers) running these operating systems:

- Windows Vista (Home Basic, Home Premium, and Ultimate editions)
- Windows XP (all editions except for x64 platforms)
- Windows 2000 Professional (Service Pack 3 and higher only)

The Windows versions supported varies by Diskeeper edition. See *Appendix A* for a table showing the different Diskeeper editions and the Windows versions they support.

File Systems Supported

Diskeeper supports the NTFS, FAT16 and FAT32 file systems.

Note that the 12-bit FAT file system is not supported. (The 12-bit FAT file system is used on FAT volumes smaller than 16 megabytes in size, such as floppy disks).

Disks Supported

Diskeeper supports a wide range of SCSI, IDE, PATA and SATA disks, including:

- Primary Partitions
- Extended Partitions
- Logical Drives
- Volume Sets
- RAID Arrays
- Mirrored Disks
- Mounted Volumes (letterless drives)

Resource Requirements

The disk space requirements for Diskeeper depend on several factors. On most systems, Diskeeper will need about 11 MB. Allow about 10 MB of extra free space for temporary files during the installation. If Internet

Explorer is not present on your computer, some other needed files (hhupd.exe, 50comupd.exe, and wintdist.exe) may be added. Further, your system may require a new or updated version of the Microsoft Management Console (MMC), which is less than 6 MB.

Additional Software Requirements

Diskeeper relies on the Microsoft Management Console (MMC). Built into Windows 2000 and later operating systems, the MMC provides a single point of control for system utilities such as Diskeeper. The MMC is used as a central location for a variety of Microsoft and third party administrative tools.

Activating Diskeeper

In some cases, you may be prompted to enter a product key in order to activate your Diskeeper purchase. Simply follow the prompts displayed to activate Diskeeper. Note that in these cases, a working Internet connection is necessary to fully activate Diskeeper.

Installation Procedure—The Short Version

The Diskeeper installation is typically fast and simple. Here are the basic steps:

Note: Make sure you are logged onto an account that is a member of the Administrators group before installing Diskeeper.

1. Insert the Diskeeper CD-ROM into the appropriate drive on your computer. (If you are installing from a downloaded file, double-click the file you downloaded.)
2. Follow the screens displayed, answering the questions asked as prompted.

   That's it! It would still be a good idea to read *After the Installation* on page 4, but you're done with the installation.

Installation Procedure—The Details

Installation Overview

Diskeeper can be installed from a CD-ROM, or it may be downloaded from the Web. This procedure applies to both methods. Before you start the installation, please note the following:

- Installing Diskeeper will not remove the built-in defragmenter, but Diskeeper will automatically become the default defragmenter. (The built-in defragmenter will be restored if you uninstall Diskeeper.)
- You must be logged into an account that is a member of the Administrators group to install Diskeeper.
- Diskeeper is installed by the SETUP.EXE program supplied on the Diskeeper CD-ROM. The SETUP.EXE program:

  a. Confirms that you have Administrator privileges.

  b. Determines which Windows version you are running.

  c. Checks for sufficient space on the disk for the installation.

  d. Detects and removes any previously installed Diskeeper software.

  e. Copies the Diskeeper files to the destination directories, updates the Windows registry, starts the Diskeeper service, creates a link in the Windows Start menu for Diskeeper, and creates a desktop shortcut (if you choose the option to do so).

Installation Procedure

This installation procedure assumes you are installing from CD-ROM. If the Diskeeper software was downloaded from the Web, double-click the executable file in the directory into which it was downloaded and go directly to step 3.

1. Insert the Diskeeper CD-ROM into the appropriate drive on your computer.
2. The Windows AutoPlay feature automatically displays a screen that allows you to install Diskeeper or choose from an assortment of trialware versions of Diskeeper Corporation products.

   If you have disabled the AutoPlay feature, simply double-click the **Setup.exe** file in the root-level folder on the CD-ROM and follow the instructions displayed.
3. Click **Next** when the welcome message appears.
4. After you have read and accepted the license agreement, click **Next** to continue.
5. As an option, you can change the destination location for the Diskeeper files. By default, Diskeeper is installed here:

   \Program Files\Diskeeper Corporation\Diskeeper

   You can choose a different disk volume or directory for the installation as follows:

   a) Click **Change**.

   b) Make the desired changes to the destination and click **OK** to accept the new destination. If the directory you specify does not exist, a new directory will be created.

   c) Click **Next**.
6. If Internet Explorer 4.01 or higher is not installed on your computer, another installation program is started and a package of necessary components is installed on your computer. Microsoft Management Console (MMC), which is the interface for Diskeeper, requires these components. These components are a small subset of Internet Explorer—not the complete Internet Explorer product. Installing these components (hhupd.exe, 50comupd.exe, and wintdist.exe) will not affect your current web browser. Note that you must restart your computer after installing Diskeeper if these components are installed.
7. If the MMC is not installed on your computer, the MMC Setup program is started automatically. After the MMC files are installed, the Diskeeper Setup program resumes.
8. Setup detects and removes any previously installed Diskeeper software. (Any previous Diskeeper settings are not saved.)
9. After Setup is complete, you can immediately start Diskeeper after clicking **Finish**.
10. To run Diskeeper, click the Windows **Start** button, select **Programs**, and then **Diskeeper Corporation Diskeeper**.

After the Installation

Registering Diskeeper

After the Diskeeper installation is complete, you may be given the option to register your Diskeeper purchase online. Be sure to register your Diskeeper purchase to receive the free 90 days of technical support included with Diskeeper.

Diskeeper Activation

In some cases, you may be prompted to activate Diskeeper after the installation. This process is simple and fast, and it helps ensure you are running a legitimate copy of Diskeeper. Diskeeper activation requires an active Internet connection, but the activation process is quick and easy to complete.

Note: If the computer on which you are installing Diskeeper does not have an active internet connection, then you will be prompted to activate the product manually. Manual activation can be done from another computer, but it must be connected to the Internet.

What is product activation?

Diskeeper product activation is an anti-piracy solution which verifies your copy of Diskeeper has been properly licensed.

How does product activation work?

Product activation works by checking that the product license is not being used on more systems than allowed in the end user license agreement (EULA). Activation is completed via the Internet, and takes only 20 seconds or less.

What information is sent to Diskeeper Corporation?

No personal information is collected, transmitted or used during activation. Only hardware identifiers and the license information are sent to Diskeeper Corporation's product activation system.

Questions?

If you have any additional questions about Diskeeper activation, contact Diskeeper Corporation as described on page 47 for more information.

Check for Product Update

The first time you run Diskeeper, it automatically checks to see if a more recent version of Diskeeper is available. If so, you are given the option to download and install the newer version. When the download screen is displayed, click **Run this program from its current location** to begin installing the update. Or, click **Save this program to disk** to save the Diskeeper update installation package on your computer for later installation. (To install an update stored on your computer in this manner, simply double-click the file you download and follow the instructions displayed.)

You can check for Diskeeper updates any time you want. Use the **Updates and Upgrades** option in the Diskeeper Configuration Properties to see if a newer version of Diskeeper is available.

About the Diskeeper Service

Diskeeper is primarily designed as a "Set It and Forget It" disk defragmenter. In order to accomplish this goal, it creates a Windows service, which facilitates communication between the operating system and the individual components that make up Diskeeper. The service allows Diskeeper to run in the background while other

applications are running. As long as your operating system is up and running, Diskeeper can defragment your disks, whether you are logged on or not.

After installation, the Diskeeper service starts automatically each time your computer is restarted. The Diskeeper service runs all the time, whether or not defragmentation is occurring. This service consumes negligible system resources, and in most cases will never need to be disabled.

The Windows Application Event Log

When running, Diskeeper places messages in the Windows Application Event Log. By default, this log is 512 kilobytes in size, and is set to overwrite events older than 7 days old. Diskeeper can potentially fill the log file if these default settings are used, particularly if you choose to log each file movement. To prevent this, perform these steps to change the size and overwriting characteristics of the Application Event Log:

1. Right-click the **My Computer** icon on your desktop and select **Manage**.
2. When the Computer Management Console is displayed, select **System Tools**, and then **Event Viewer**.
3. Expand the Event Viewer (by double-clicking it) and select **Application**.
4. Next, click the **Action** menu and select **Properties**.
    a) Set the **Maximum log size** to **2048** KB.
    b) Enable the **Overwrite events as needed** option.
    c) Click **OK**.

Diskeeper allows you to specify what information is written to the Application Event Log. For more information, see page 34.

A Note about Firewalls

As a normal part of its operation, the Diskeeper Service (DkService.exe) acts as a server on your system. If you are running a hardware or software firewall, you may see messages indicating Diskeeper Service is trying to act as a server. These messages are expected; you can safely allow these events. This functionality is designed to allow for support for network operations (e.g. Remote Control) via Diskeeper Administrator. You may also be notified that Diskeeper is trying to access the Internet. It is important to note that Diskeeper does not access the Internet (except when you specifically use the Check for Updates feature), but it does use Windows mechanisms that may trigger these alerts from your firewall. Again, these messages are expected and you can safely allow the events. If networkability or automatic update checking is not required, you can safely disable this.

Repairing Windows Systems

Performing an emergency repair, upgrade or reinstallation of a Windows system can possibly change or disable certain system information or services, which may make it necessary to reinstall Diskeeper after repairing your Windows system.

Uninstalling Diskeeper

To uninstall Diskeeper, you must be logged into an account that is a member of the Administrators group.

Note that the controls may have slightly different names, depending on your version of Windows.

Follow these steps to completely remove and uninstall Diskeeper from your computer:

1. From the Control Panel, double-click **Add/Remove Programs**.
2. Highlight the **Diskeeper** entry.

3. Click **Remove**. This removes the Diskeeper program files from your computer. In most cases, the Diskeeper installation directory will not be removed.

4. Manually delete the Diskeeper installation directory if it exists.

When Diskeeper is uninstalled, the Windows Disk Defragmenter is restored to the state it was in before Diskeeper was installed.

Note: If the Microsoft Management Console (MMC) has been installed on your computer, it will not be removed when Diskeeper is uninstalled.

Chapter 2

Getting Started

This chapter explains how to analyze the fragmentation on a disk volume, save the results, defragment the volume, and do a “before and after” comparison.

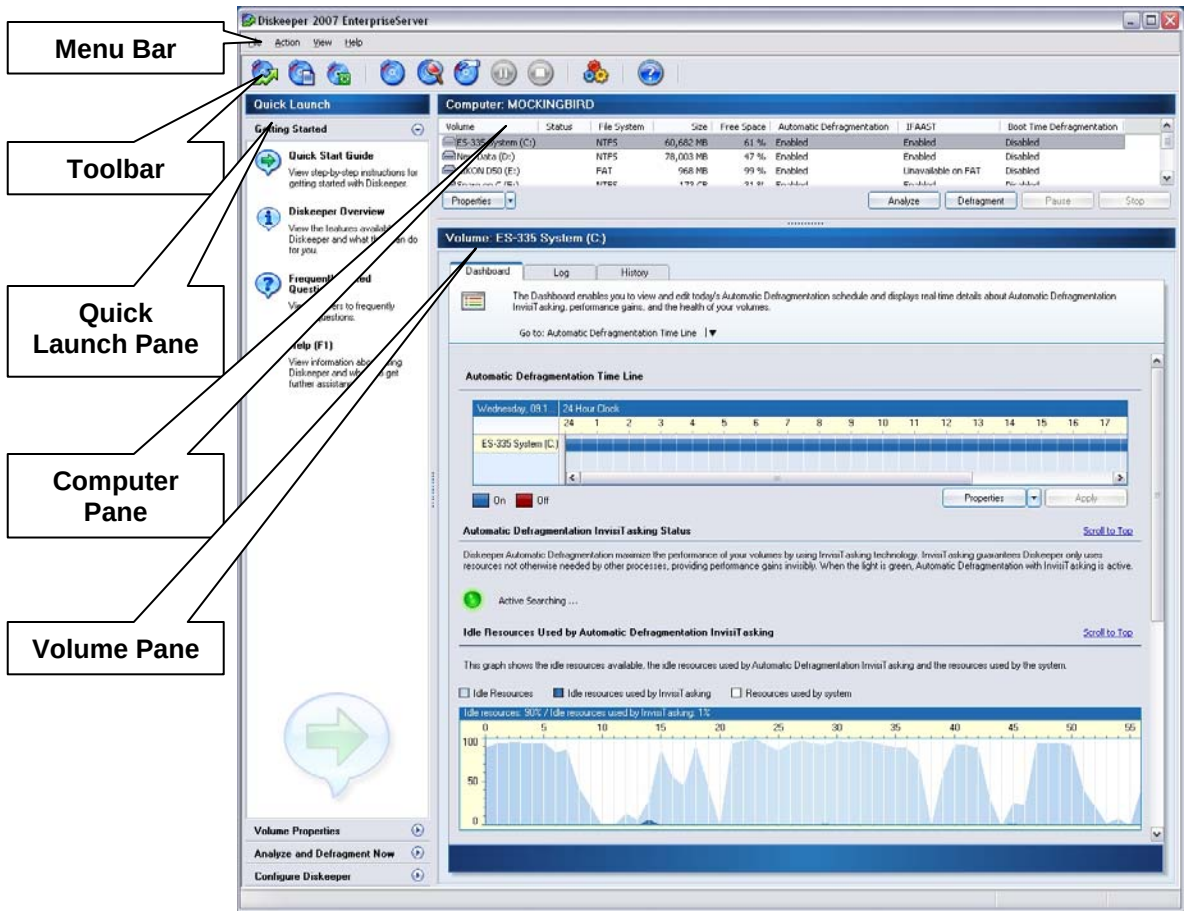
Introduction

If you are new to Diskeeper, here are some helpful tips for getting the best results.

Diskeeper has an entirely new approach to defragmenting when compared to what you may be accustomed to. Diskeeper was designed to allow you to automate background defragmentation without impacting the use of other programs. This procedure will demonstrate how to set up and use Diskeeper as it is intended to be used—for automatic system maintenance.

The Diskeeper Console

Before we go too far, here’s a look at the Diskeeper console. The following examples shows the Diskeeper EnterpriseServer console – the Diskeeper Home console will differ slightly:



Menu Bar — The Diskeeper menus provide an alternative way to access the features available from the toolbar and Quick Launch pane.

Toolbar — The Diskeeper toolbar gives quick access to commonly-used controls. Note that all the functions on the toolbar are available from the Diskeeper menus, and many can also be activated from the menu displayed when you right-click on a selected volume in the volume area. See page 16 for more information.

Quick Launch Pane — The Quick Launch pane is where you'll find easy access to the commonly-used Diskeeper features, as well as several shortcuts for performing common tasks. See page 17 for more information.

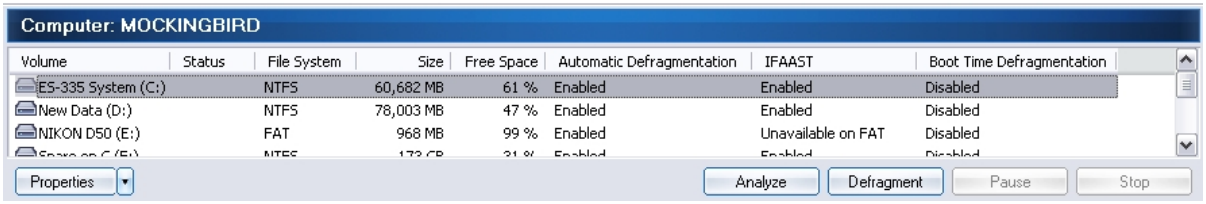
Computer Pane — The Computer pane shows all the supported disk volumes detected on your computer, and defragmentation status and general information about each volume. See page 17 for more information.

Volume Pane — The tabs in the Volume pane area allow you to easily change between the Dashboard tab, the Log tab, and the History tab. See page 18 for more information.

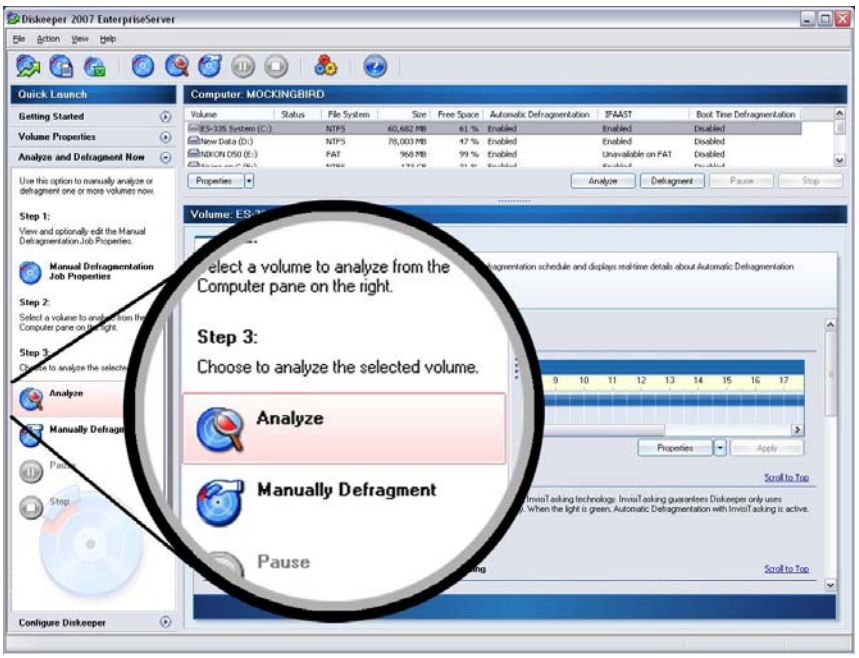
Let's Look At Your Hard Drive

The following brief steps will give you a quick and easy demonstration of Diskeeper on your own workstation or server, and show you the recommended settings.

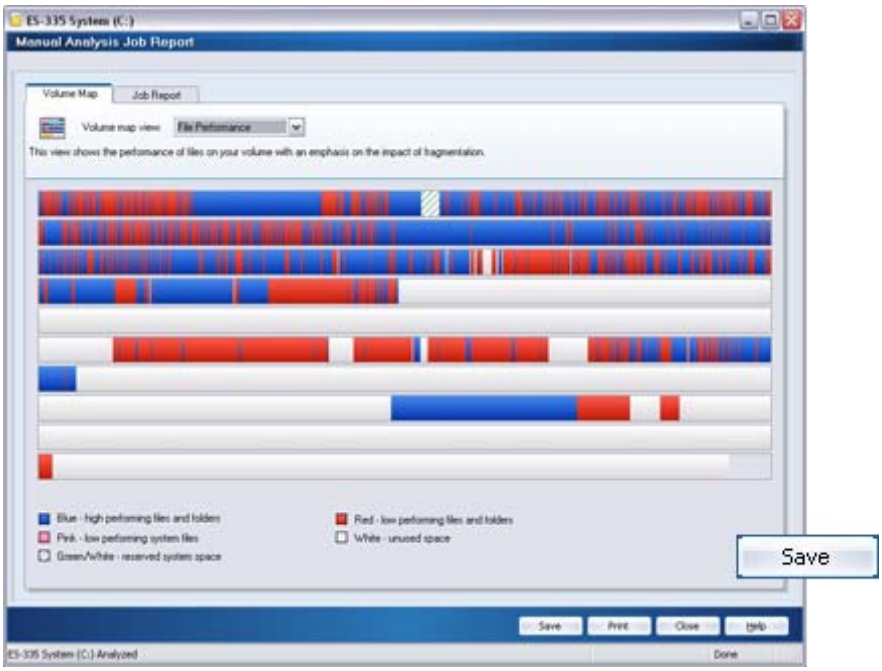
1. In the Computer pane, locate and select one of the volumes on your computer.



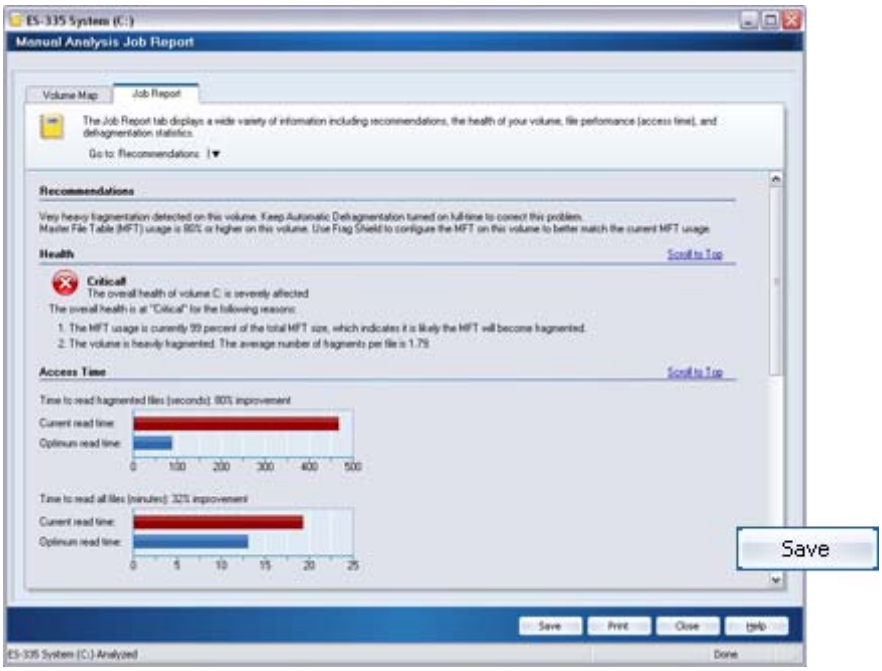
2. In the Quick Launch pane, expand the **Analyze and Defragment Now** task. Next, click **Analyze** to start the analysis. Keep in mind the analysis may take a few seconds—the larger your volume, the longer this will take.



3. The Volume Map tab gives you an at-a-glance view of the condition of your volume. As the legend at the bottom of the screen explains, the red areas show the extent of fragmentation on the volume. You can click **Save** at the bottom of the screen to save a bitmap file of the Volume Map.



4. After the analysis finishes, click the **Job Report** tab. The Job Report tab provides fragmentation statistics, volume health information, file access times, lists of the most fragmented files on the volume, and recommendations for achieving and maintaining optimal performance. Save this particular analysis by clicking **Save** at the bottom of the Job Report.


ES-335 System (C:)
Manual Analysis Job Report
Volume Map
Job Report
The Job Report tab displays a wide variety of information including recommendations, the health of your volume, file performance (access time), and defragmentation statistics.
Go to: Recommendations
Recommendations
Very heavy fragmentation detected on this volume. Keep Automatic Defragmentation turned on full-time to correct this problem.
Master File Table (MFT) usage is 80% or higher on this volume. Use Frag Shield to configure the MFT on this volume to better match the current MFT usage.
Health
Scroll to Top
Critical!
The overall health of volume C: is severely affected
The overall health is at "Critical" for the following reasons:
1. The MFT usage is currently 99 percent of the total MFT size, which indicates it is likely the MFT will become fragmented.
2. The volume is heavily fragmented. The average number of fragments per file is 1.79.
Access Time
Scroll to Top
Time to read fragmented files (seconds): 80% improvement
Current read time:
Optimum read time:
0
100
200
300
400
500
Time to read all files (minutes): 32% improvement
Current read time:
Optimum read time:
0
5
10
15
20
25
Save
Save
Print
Close
Help
ES-335 System (C:) Analyzed
Done

5. Repeat steps 1 through 4 above for each volume on your system.

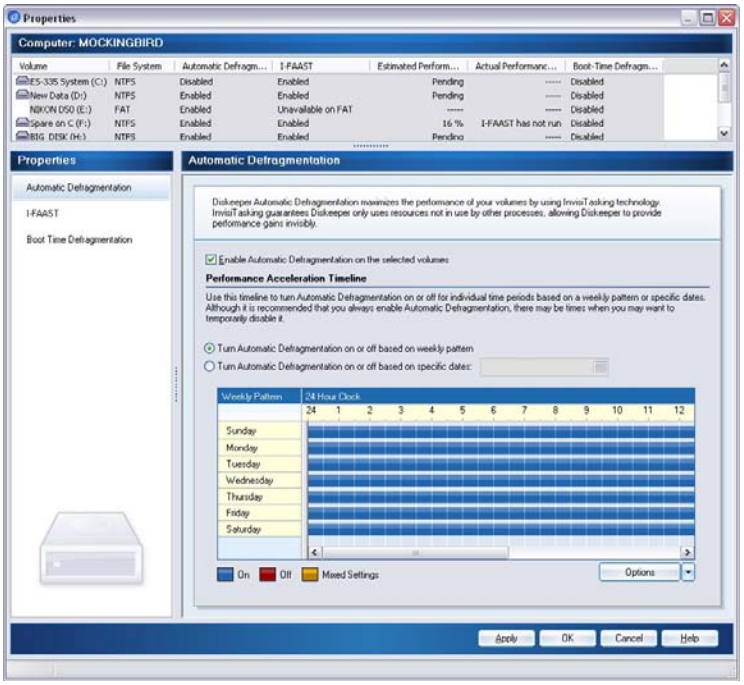
Automatic Defragmentation

During installation you were given the option to enable Automatic Defragmentation. By default it is enabled on all your volumes, and we recommend keeping it turned on. Automatic Defragmentation defragments files and free space on the fly. As fragmentation occurs, Diskeeper will handle it, in real-time!

If you did not enable Automatic Defragmentation during the installation, we recommend you follow the steps below to Set It and Forget It®.

Expand the Volume Properties task group in the Quick Launch pane, and select the **Automatic Defragmentation** option. Highlight all the drives on your system (you can hold down the <Ctrl> key and select more than one volume), select **Enable Automatic Defragmentation on the selected volumes**, then click **OK**.

Quick Launch
Getting Started
Volume Properties
Automatic Defragmentation
Diskeeper Automatic Defragmentation maximizes the performance of your volumes by using InvisiTasking technology. InvisiTasking guarantees Diskeeper only uses resources not in use by other processes, allowing Diskeeper to provide performance gains invisibly.



Congratulations, you're done!

From this point on, Diskeeper will automatically maintain your volumes, working in the background with no further intervention from you.

Following Up

To check on Diskeeper progress, open Diskeeper the next day and re-run the analysis on each of your volumes. Repeat steps 1 through 5 above to record analysis data (remember to save the results to a different file name than the "before" analysis results). By comparing the "before" and "after" reports, you can see the benefit Diskeeper provides to your system's performance and reliability.

The Historical Report tab is another great way to see the benefits of automatic defragmentation. The Historical Report shows graphs indicating the total number of fragments eliminated, the overall fragmentation level, and the file performance improvement gained by using Diskeeper. This information is shown for your computer overall, as well as on a per-volume basis. As you highlight each volume in the Computer pane, the information displayed in the Historical Report changes to reflect the selected volume.

Each graph in the Historical Report shows "before and after" results. Over time, the Historical Report tab will give you a good measure of the benefit Diskeeper provides.

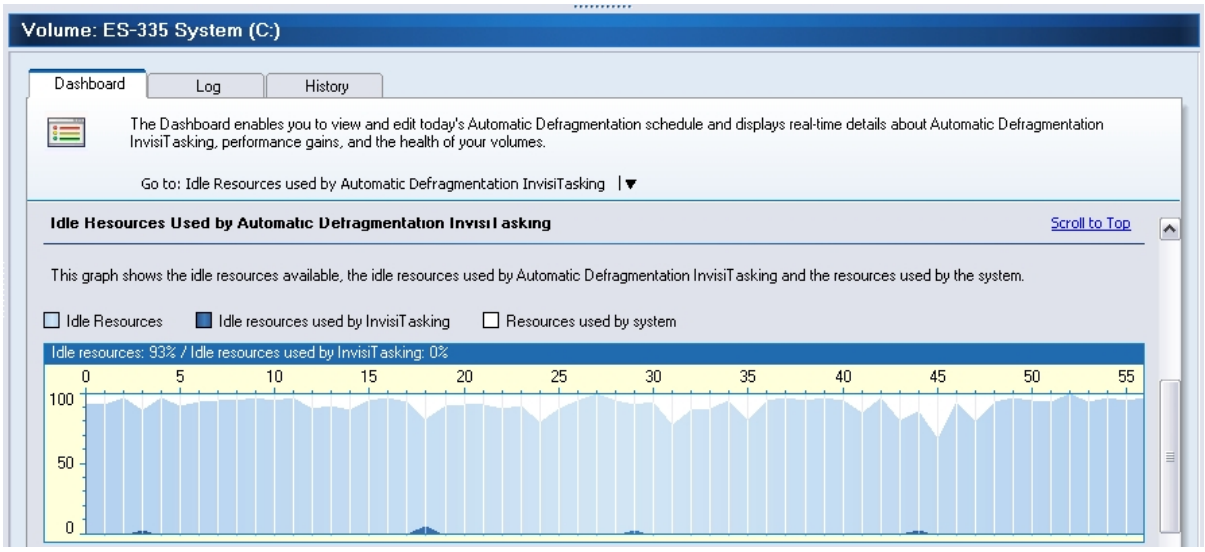
Making Diskeeper Operation Transparent

Diskeeper's revolutionary new InvisiTasking technology guarantees that Diskeeper will use only system resources that would be otherwise be wasted (idle time).

This technology allows Diskeeper's real-time defragmentation to continually keep your disk volumes in top shape, and ensures your computer's performance is never slowed down by the defragmentation process itself.

Diskeeper is designed to be run automatically in the background, so if you run Diskeeper manually, note that additional resources are required to continually refresh the user interface.

Also note that Manual Defragmentation jobs do not use InvisiTasking and will have a noticeable impact on your system when the job is running. Of course, with Diskeeper's automatic technologies, manual defragmentation is not necessary.


Volume: ES-335 System (C:)
Dashboard
Log
History
The Dashboard enables you to view and edit today's Automatic Defragmentation schedule and displays real-time details about Automatic Defragmentation InvisiTasking, performance gains, and the health of your volumes.
Go to: Idle Resources used by Automatic Defragmentation InvisiTasking
Idle Resources Used by Automatic Defragmentation InvisiTasking
Scroll to Top
This graph shows the idle resources available, the idle resources used by Automatic Defragmentation InvisiTasking and the resources used by the system.
Idle Resources
Idle resources used by InvisiTasking
Resources used by system
Idle resources: 93% / Idle resources used by InvisiTasking: 0%
0 5 10 15 20 25 30 35 40 45 50 55
100
50
0

Summary

Remember that Diskeeper will defragment files and free space fragmentation on the fly. You never need to schedule or manually run defragmentation ever again. And with InvisiTasking, all you'll notice is that your system stays at top speed all the time!

Chapter 3

Overview of Diskeeper

This chapter provides important general information about Diskeeper.

Diskeeper Features

The following list summarizes the most important Diskeeper features:

Automatic Operation — Diskeeper is designed to operate without your intervention. Simply install Diskeeper, then sit back and let it take care of the details. Of course, you can also run Diskeeper manually. (But you probably have better things to do with your time. That's what Automatic Defragmentation with InvisiTasking is for!) See page 20 for more information about Automatic Defragmentation.

Diskeeper Family of Products — The Diskeeper family of products offers specialized automatic defragmentation of Windows operating systems ranging from Windows 2000 through Windows XP and Windows Server 2003 Datacenter. See the tables in *Appendix A* for the complete Diskeeper lineup.

Descriptive Console Interface — The Diskeeper console provides an intuitive and informative defragmentation experience. Common commands are grouped together in the Quick Launch pane, and a group of tabbed panes show you a wide variety of information. Diskeeper shows you the condition of your disks, and provides suggestions for improving or maintaining your disks. See page 18 for more information.

Performance and Volume Health Analysis — Diskeeper collects and displays data regarding the performance and overall health of your volumes in the Dashboard tab. This information allows you to be more proactive in the management and maintenance of your computers. See page 18 for more information.

Boot-Time Defragmentation — Defragment files at boot-time that cannot be moved safely when Windows is running. See page 21 for more information.

Exclusion Lists — Diskeeper exclusion lists allow you to specify files and directories that will not be allowed to be processed by Diskeeper. See page 32 for more information.

Event Logging — Diskeeper records information about its activity in two ways. First, general information about previously-run defragmentation job is shown in the Log tab within the Diskeeper console. Additional information can also be stored in a log file. A wide variety of information can be saved for future reference. See page 34 for more information.

Other Things to Know

- When running Diskeeper in Automatic mode, you can run other tasks while defragmentation is occurring.
- With the exception of boot-time operations, Diskeeper runs as a Windows Service and it optionally logs useful defragmentation information into the Windows Application Event Log.
- Diskeeper can be uninstalled in the standard manner using the Add/Remove Programs applet in the Windows Control Panel.
- You must be logged into an account that is a member of the Administrators group to run Diskeeper.

Exclusion List

In some cases, you may have files or directory folders you do not want to defragment. For example, you may not want to defragment temporary files that will soon be deleted. Any files or directories can be excluded from Diskeeper processing by adding them to the exclusion list.

For more information, see page 24.

Event Logging

Diskeeper allows you to record information about its activity in a log file. You can alternately enable or disable the logging of various events to the Diskeeper Event Log. The logging method varies, depending on the version of Windows you are using.

For more information, see page 34.

Getting the Most from Diskeeper

Diskeeper provides a variety of features, all of which are designed to help you get the best performance from your computer. While there are no “hard and fast” rules governing the use of Diskeeper, here are some general guidelines that will help you get the most from Diskeeper.

- When you first install Diskeeper, analyze all the disk volumes on your computer. This gives you good information about the extent of fragmentation on your computer.
- After you have analyzed your volumes, enable Automatic defragmentation on each of your volumes. The Diskeeper InvisiTasking technology ensures that Diskeeper uses only otherwise unused computer resources to keep your volumes defragmented. For more information on Automatic defragmentation, see page 20.
- If the analysis shows fragmentation of the Master File Tables (MFTs) or paging files of your volumes, you should next prepare for Boot-Time defragmentation to defragment MFTs and paging files. Since these critical system files cannot be moved while your operating system is up and running, the Boot-Time defragmentation operation defragments the paging file and/or MFT on your volumes while your computer is booting. After running the Boot-Time operation once, regular online defragmentation by Diskeeper can help prevent the MFT and paging file from becoming fragmented again.

  It is recommended you run the Boot-Time defragmentation operation on one disk volume at a time, because it can be time consuming and the computer cannot be used for any other purpose while the boot-time program is running.

  Also, it is important to defragment your volumes before running the Boot-Time defragmentation in order to create a contiguous free space for your directories and/or paging files to be moved into. For more information about Boot-Time defragmentation, see page 21.

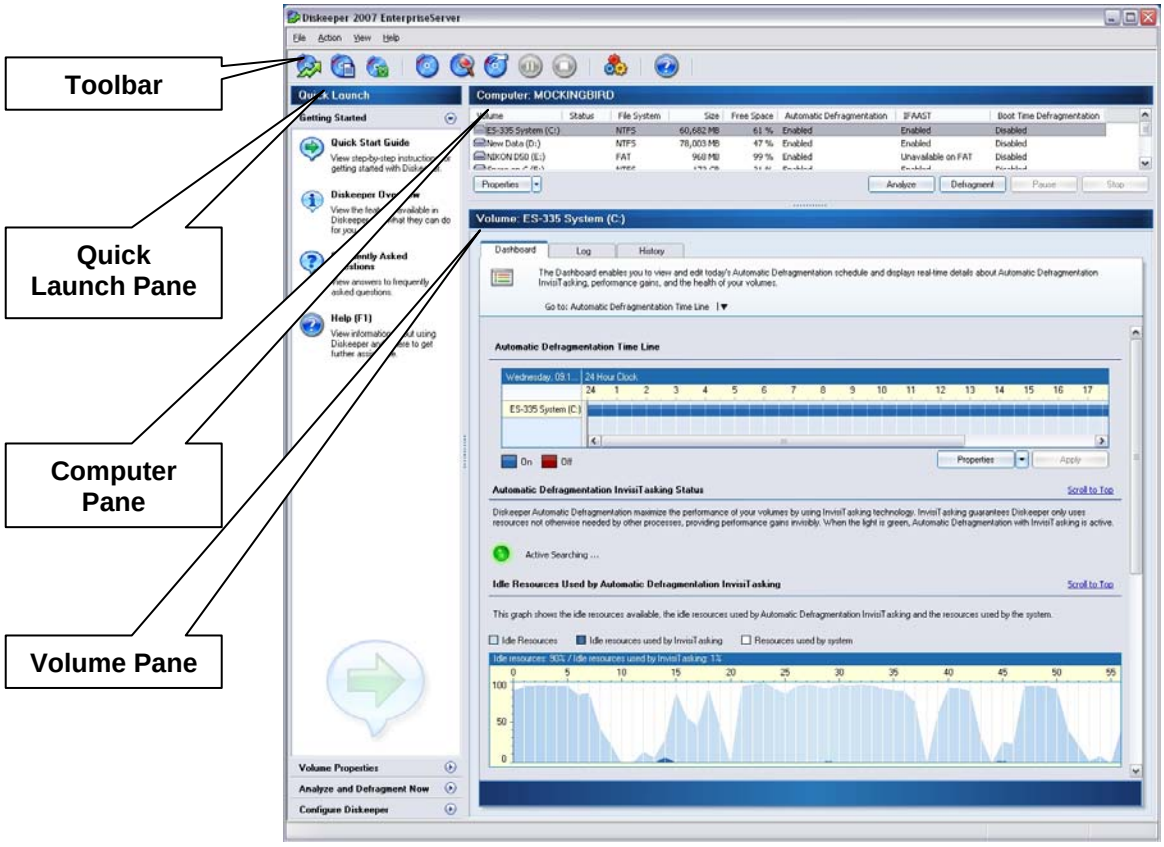
Chapter 4

Diskeeper Operation

This chapter describes how to operate Diskeeper.

The Diskeeper Interface

As briefly explained in Chapter 2, the Diskeeper user interface (or console) is made up of several distinct components. Of particular note:



Toolbar — The Diskeeper toolbar gives quick access to commonly-used controls. Note that the functions on the toolbar are also available from the Diskeeper menus, and many can also be activated from the menu displayed when you right-click on a selected volume in the volume area. See page 16.

Quick Launch Pane — The Quick Launch pane is where you'll find easy access to the commonly-used Diskeeper features, as well as several shortcuts for performing common tasks. See page 17.

Computer Pane — The Computer pane shows all the supported disk volumes detected on your computer, and general information about each volume. See page17.

Volume Pane — The tabs in the Volume pane allow you to easily change between the Dashboard, the Log, and the History views. See page 18.

Toolbar Buttons

Diskeeper displays a toolbar of commonly-used controls near the top of the console.

Note that many of the functions on the toolbar are available from the **Action** menu, and are also shown as options when you right-click on a volume in the Computer pane.

Automatic Defragmentation Properties Button — Click this button in the Diskeeper toolbar or within the **Volume Properties** task in the Quick Launch pane to enable Automatic Defragmentation on the selected volumes and to view and edit the properties applied to that job.

Boot-Time Defragmentation Job Properties Button — Click this button in the Diskeeper toolbar or within the **Volume Properties** task in the Quick Launch pane to enable a Boot-Time Defragmentation job on the selected volumes and to view and edit the schedule and other properties applied to that job.

Manual Defragmentation Properties Button — Click this button in the Diskeeper toolbar or within the **Analyze and Defragment Now** task in the Quick Launch pane to view and edit the properties applied to all Manual Defragmentation jobs.

Analyze Button — Click this button in the Diskeeper toolbar, the **Analyze** option in the Quick Launch pane, or the **Analyze** option on the Action menu to begin the analysis of the selected volume.

Defragment Button — Click this button in the Diskeeper toolbar, the **Manually Defragment** option in the Quick Launch pane, or the **Defragment** option on the Action menu to start Manual Defragmentation of the selected volume.

Pause Button — Click this button in the Diskeeper toolbar or the **Pause** option in the Action menu to temporarily pause the analysis or defragmentation of the selected volume. Note that the Pause button changes to the Resume button shown below when analysis or defragmentation is paused.

Resume Button — Click this button in the Diskeeper toolbar or the **Resume** option in the Action menu to continue a paused Diskeeper analysis or defragmentation.

Stop Button — Click this button in the Diskeeper toolbar or the **Stop** option in the Action menu to stop analysis or defragmentation of the selected volume. Any file movement in progress will be safely ended as Diskeeper stops.

Diskeeper Configuration Properties Button — Click this button in the Diskeeper toolbar or within the **Configure Diskeeper** task in the Quick Launch pane to view and edit properties that determine how Diskeeper looks and behaves

Help Button — Click this button in the Diskeeper toolbar or within the **Getting Started** task in the Quick Launch pane to access the Diskeeper help.

Quick Launch Pane

The Quick Launch pane offers these separate task groups:

Getting Started — Use this task group to view Help topics intended to help you begin using Diskeeper. These options are available:

- Quick Start Guide
- Diskeeper Overview
- Frequently Asked Questions
- Help

Volume Properties — Use this task group to set up defragmentation properties and enable defragmentation of your volumes, and to review or change the properties for the respective volumes. These options are available:

- Automatic Defragmentation Properties
- Boot-Time Defragmentation Properties

Analyze and Defragment Now — Use this task group to start the manual analysis or defragmentation of a volume, and to review or change the properties for all Manual Defragmentation operations. These options are available:

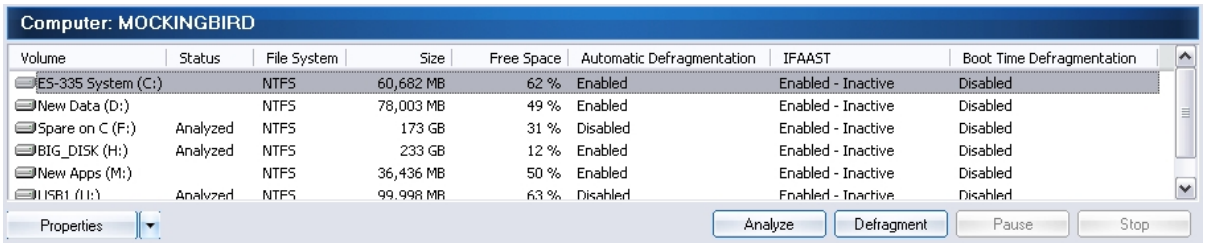
- Manual Defragmentation Properties
- Analyze
- Manually Defragment

Configure Diskeeper — Use this task group to change Diskeeper behaviors, check for more recent versions of Diskeeper, or see information about the Diskeeper version installed on your computer. These options are available:

- Diskeeper Configuration Properties
- Updates and Upgrades
- About Diskeeper

Computer Pane

The Computer pane section of the Diskeeper console shows all the supported disks detected on your computer. Be aware that this example shows the Diskeeper EnterpriseServer console – the Diskeeper Home console will differ slightly:



The Computer pane is a quick way to see:

- Volume letter and name
- Status (shows what Diskeeper is doing or has done on the volume)

- File system on the volume
- Capacity of the volume
- Percentage of volume size that is free space
- Information showing whether Automatic Defragmentation or Boot-Time Defragmentation are enabled on the volume.

The Computer Pane also includes buttons for starting, pausing and stopping manual analysis and defragmentation jobs.

Volume Pane

The tabbed “pages” in the Volume pane allow you to easily change between the Dashboard, Log, and History views.

Dashboard Tab

The Dashboard tab displays real-time details about Automatic Defragmentation, the health of your volumes, the idle resources that Diskeeper uses to accelerate volume performance, and other useful defragmentation information. The Dashboard tab includes these sections:

Automatic Defragmentation Timeline

This section of the Dashboard tab shows the time periods when Automatic Defragmentation is turned on. Automatic defragmentation with InvisiTasking uses only otherwise unused system resources, so it will not negatively impact the performance of other applications on the system at any time. For this reason, it is recommended that you keep Automatic Defragmentation turned on all the time.

Most Recently Defragmented Files

This section of the Dashboard tab shows a list of the most recently defragmented files on the selected volume.

Volume Health and Recommendations

This section of the Dashboard tab includes an evaluation of the overall health of the volume, the reasons for that rating, and recommendations for improving or maintaining the reliability of the volume.

Diskeeper Corporation has done extensive research into the causes of disk performance and reliability problems. This research has shown these factors play a significant role in regards to disk performance and reliability—the overall health of a disk volume:

- Overall fragmentation
- MFT fragmentation
- Paging file fragmentation
- Available free space

Diskeeper uses these factors to determine a volume health index each time it analyzes or defragments a volume.

Volume health is rated into three categories—Healthy, Warning and Critical.

This table shows the Warning and Critical levels used in determining the reliability index.

Reliability Factor	Warning Level	Critical Level
Overall Fragmentation	> 10% fragmentation	> 50% fragmentation
MFT Fragmentation	> 250 fragments	>2000 fragments
Paging File Fragmentation	> 250 fragments	>1500 fragments

Free Space	< 15% free space	< 5% free space

Log Tab

The Log tab shows information about all the defragmentation operations you have run on each volume. As you highlight each volume in the Computer pane, the information displayed in the Log tab changes to reflect the selected volume. The Log tab information includes:

- **Job Type**—This column shows the type of defragmentation run (Automatic or Manual defragmentation)
- **Date**—This column shows the date each defragmentation operation was performed.
- **Volume**—This column shows volume label for the selected volume.
- **Times Run**—This column shows the number of times each particular defragmentation type has been run on the selected volume.
- **Fragments Eliminated**—This column shows a cumulative total of the number of fragments eliminated for each defragmentation type.

The Log saves up to six months worth of data. New data afterwards will overwrite the oldest data in the Job.

You can also save the Log (as an HTML file) or print it by using the respective buttons on the Job tab.

History Tab

The History tab shows graphs indicating the total number of fragments eliminated, the overall fragmentation level, and the file performance improvement gained by using Diskeeper. This information is shown for your computer overall, as well as on a per-volume basis. As you highlight each volume in the Computer pane, the information displayed in the History tab changes to reflect the selected volume.

Each graph in the History tab shows “before and after” results. Over time, the History tab will give you a good measure of the benefit Diskeeper provides. Hover your pointer over each point of the graph to see more detailed information about that point

Use the controls at the bottom of the display to customize the scale and range of the graphs. You can also save the report (as a bitmap file) or print it by using the respective buttons on the History tab.

Saving and Printing Volume Pane Information

Click the **Save** or **Print** buttons at the bottom of the Log tab or History tab pages in the Volume pane to save or print the information shown on that tab. When you save dashboard information, the file format varies depending on the tab:

Log Tab — saves as an HTML (.htm) file

History Tab — saves as a bitmap (.bmp) file

When you click **Save**, a dialog box is displayed allowing you to specify the name of the file and the location where you want to store it.

Similarly, when you click **Print**, a dialog box is displayed allowing you to specify the printer and any print properties available.

Volume Properties

Automatic Defragmentation and Boot-Time Defragmentation are applied on a per-volume basis. Because of this, changes to the behavior of these core Diskeeper features can be seen as “properties” that apply to each volume. Control of these properties is done through the Volume Properties console, which is displayed in a window separate from the main Diskeeper console.

Click **Volume Properties** in the Quick Launch pane and select any of the option shown to launch the Volume Properties console and modify the Automatic Defragmentation or Boot-Time Defragmentation properties on one or more volumes.

Once it has been opened, the Volume Properties console give you easy access to the properties for Automatic Defragmentation and Boot-Time Defragmentation operations. Choose any of the options in the Properties pane on the left side of the console to view or edit the properties for that option.

Automatic Defragmentation Overview

In Automatic Defragmentation mode, Diskeeper works automatically in the background, with no negative performance impact on other applications that are running, improving the performance of your computer without slowing down other operations while doing so. For this reason, Automatic Defragmentation is the recommended method for keeping your computer running at its peak potential. By default, Automatic Defragmentation is enabled on all your volumes with Diskeeper is installed.

Follow these steps to open the Automatic Defragmentation page of the Volume Properties console and enable or disable Automatic Defragmentation on one or more volumes:

1. Open the **Volume Properties** task group in the Quick Launch pane and select **Automatic Defragmentation**.

Tip: You can also use the **Automatic Defragmentation** button to open the Automatic Defragmentation properties page.

2. Select one or more volumes in the Computer pane.
3. Select or clear the **Enable automatic defragmentation on the selected volumes** checkbox and click **OK** to save your changes and close the Volume Properties console, or click **Apply** to save your changes and keep the Volume Properties console open.

When Automatic Defragmentation is enabled on a volume, you can optionally use the Automatic Defragmentation Timeline control to specify times when Automatic Defragmentation will not be allowed to run. Keep in mind that Automatic Defragmentation, with the exclusive InvisiTasking technology, works invisibly in the background, and will not negatively impact other processes on the computer. When Automatic Defragmentation is not enabled on a volume, fragmentation increases, and performance suffers. For this reason, specifying a time for Automatic Defragmentation to not run is comparable to specifying a time when you want your computer’s performance to be less than optimum.

If you exit from Diskeeper (or even log off your computer) while Automatic Defragmentation is running, it will continue running as needed.

Automatic Defragmentation Timeline

Since Automatic Defragmentation uses InvisiTasking technology to run unnoticed in the background, there usually is no need to turn it off. However, for rare cases such as benchmarking where you do not want the benefits from Automatic Defragmentation to skew the results, the Automatic Defragmentation Timeline allows you to specify exclusion periods when Automatic Defragmentation will be turned off.

The colored horizontal bars in the Automatic Defragmentation Timeline represent periods of time, and the colors show periods when Automatic Defragmentation is turned on or off. In cases where more than one volume has been selected, any conflicting exclusion periods are displayed in a separate color as shown in the legend at the bottom of the timeline display. These time periods are shown in the timeline as “mixed settings”.

You can turn Automatic Defragmentation on or off based on a weekly pattern, or based on specific dates you choose. When the weekly pattern option is chosen, the timeline shows a full week in one-hour increments. When the specific date option is chosen, use the calendar control to specify one or more days to display in the timeline.

After selecting the range of time displayed in the timeline, left-click and drag your cursor on any of the segments in the display to alternately enable and disable Automatic Defragmentation for that time period. You can quickly select any time span from a single hour to several days at once.

Use the **Options** button at the bottom of the Automatic Defragmentation Timeline to include or exclude all of the time period shown in the timeline, to change between a 12-hour and 24-hour clock, and to customize the color used to show the exclusion period.

Boot-Time Defragmentation Overview

Boot-Time Defragmentation consists of three independent activities:

- **Directory Defragmentation and Consolidation**—moves directories to a single location. Note that on NTFS volumes, directories can be moved and defragmented online, which makes directory consolidation on these volumes unnecessary. However, Boot-Time directory defragmentation and consolidation can be useful on FAT volumes.

  The various editions of Windows write directories into random locations all over a volume. This, in effect, breaks up the free space on the volume. By grouping all the directories into a single location on a volume, larger areas of contiguous free space become available. Therefore, new files are more likely to be written to the volume in a contiguous manner. This also helps make Diskeeper more effective when it is run in either the Automatic or Manual defragmentation modes.

- **Paging File Defragmentation**—defragments the paging file. Fragmented paging files can slow Windows performance. They can also hurt the effectiveness of Diskeeper, since the unmovable paging file fragments break up the free space on the volume. By defragmenting your paging file, you can help maintain peak Windows performance, and help Diskeeper run better at the same time. After a paging file has been defragmented, it should remain contiguous unless its size is changed.

- **Master File Table (MFT) Defragmentation**—defragments the Master File Table (MFT). The MFT is a critical section of Windows NTFS disk volumes. The MFT is used by the NTFS file system to locate files on a volume, so fragmentation of the MFT slows the retrieval of files on the disk—whether these files themselves are fragmented or not. Defragmenting the MFT will improve the overall performance of the volume.

  Note that on Windows XP, most, but not all of the Master File Table can be defragmented by Diskeeper during normal Automatic or Manual defragmentation operations. Boot-Time Defragmentation is still required to fully defragment the MFT.

Boot-Time Defragmentation opens up larger areas of contiguous free space for new file creation and modification.

Important: For best results with Boot-Time Defragmentation, Diskeeper Corporation strongly recommends:

1. Make sure you have sufficient contiguous free space. Delete unneeded files and perform one or more manual defragmentation runs to defragment the volume as much as possible.

2. Enable the **Run the system “CHKDSK” utility before defragmentation** option. This will help prevent vital files from being moved to bad disk sectors.

3. Boot-Time Defragmentation can take a long time, especially on very large disk volumes that are severely fragmented. Therefore, before running it, you should:
   - Schedule the Boot-Time Defragmentation on weekends or other time when the machine is not needed immediately.
   - Perform the Boot-Time Defragmentation on only one disk volume at a time.

Several points about Boot-Time Defragmentation:

- Keep in mind that for maximum efficiency, the Boot-Time Defragmentation operation concentrates only on files that cannot be defragmented online. It is not intended to defragment all the files on your disk.
- Boot-Time Defragmentation relies on having a contiguous free space into which to move the directories and/or paging file on your volume. Therefore, it is beneficial to run Diskeeper in either the Automatic or Manual Defragmentation mode *before* running Boot-Time Defragmentation.
- Boot-Time Defragmentation is a one-time operation. After it runs on a volume, it is not automatically set up to run again. You must set it each time you want it to run on a volume. It is usually not necessary to run Boot-Time Defragmentation repeatedly on a volume.
- It is safe to restart your computer midway through the Boot-Time Defragmentation operation. However, if you do so, you should use the Error Checking option in **Drive Properties | Tools** on the volume that was being processed when you restarted your computer, and enable both the fix and the scan options, or (if you are running from the Windows Command Prompt) run CHKDSK, using the /F qualifier. This ensures the files and free space on the volume are correctly allocated.
- After running Boot-Time Defragmentation, use Automatic Defragmentation to keep the volume defragmented.

Boot-Time Defragmentation Properties

Follow these steps to open the Boot-Time Defragmentation page of the Volume Properties console and enable or disable Boot-Time Defragmentation on one or more volumes:

1. Open the **Volume Properties** task group in the Quick Launch pane and select **Boot-Time Defragmentation**.

Tip: You can also use the **Boot-Time Defragmentation** button to open the Boot-Time Defragmentation properties page.

2. Select one or more volumes in the Computer pane. Keep in mind that each volume will be processed in sequence, and the operation can take a considerable time when multiple volumes are selected. For this reason, it is recommended that you only run Boot-Time Defragmentation on one volume at a time.
3. Select or clear the **Enable Boot-Time Defragmentation to run on the selected volume** checkbox and click **OK** to save your changes and close the Volume Properties console, or click **Apply** to save your changes and keep the Volume Properties console open.

The following controls are available in the Boot-Time Defragmentation properties page:

Computer Pane

Use this section of the Boot-Time Defragmentation properties page to specify the volume(s) upon which you want to run Boot-Time Defragmentation. You can select more than one volume at a time, but be aware that the volumes will be processed one at a time, and your computer will be restarted automatically after each volume is processed. This will substantially increase the time needed to complete the operation.

Enable Boot-Time Defragmentation to run on the selected volume

Use this option to enable Boot-Time Defragmentation on the volumes you select in the Computer pane. When Boot-Time Defragmentation is enabled, you can choose from any one of these options:

- **Run Boot-Time Defragmentation the next time this computer is manually rebooted**—The boot-time operation will take place the next time the computer is rebooted
- **Run Boot-Time Defragmentation based on a scheduled time**—These controls specify when the computer will be automatically rebooted. Choose a date and time with the controls provided.

  About one hour before a scheduled Boot-Time Defragmentation is due to be run, a message is broadcast at regular intervals to all users logged on to the computer, informing them that a scheduled reboot is about to take place and requesting them to log off. If at the scheduled time someone is still logged on and **Run Boot-Time Defragmentation even if this volume is being used by remote users** is cleared, the computer will not reboot, but will instead perform the Boot-Time defragmentation the next time the computer is rebooted manually. If this option is set, however, the machine will reboot at the scheduled time, regardless of whether or not any users are logged on.

Put all folders together on the volume

Select this option to defragment and consolidate the directories of the selected volumes, the next time your computer starts up. This option is not available on NTFS volumes when Automatic Defragmentation is enabled on the volume, since this is done automatically when Diskeeper is running online.

Defragment the paging file

Select this option to defragment the paging file of the selected volume the next time your computer starts up.

Defragment the Master File Table (MFT)

Select this option to defragment the MFT of the selected volume the next time your computer starts up.

Run the system "CHKDSK" utility before defragmentation

Use this control to specify whether the Windows CHKDSK disk error checking utility is run (using the /F qualifier) before the boot-time operation. Running CHKDSK adds time to the Boot-Time Defragmentation operation, but it can correct disk errors that otherwise would hamper effective directory consolidation.

Note: Enabling the CHKDSK option will cause CHKDSK to run on each selected volume before the Boot-Time Defragmentation process. The time increase can be considerable and Diskeeper Corporation therefore recommends performing boot-time defragmentation on one volume at a time.

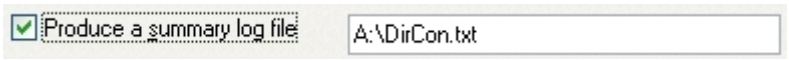
Also Note: After enabling the CHKDSK option, neither Automatic nor Manual Defragmentation will be able to run on the disk until you reboot. For this reason, Diskeeper Corporation recommends waiting to enable this option until just before you are ready to reboot your computer.

Pause to view screen after defragmentation

When enabled, this option causes the Boot-Time Defragmentation operation to pause after completion. It remains in this paused state until you manually restart your computer (by either pressing the Reset button or turning off the power switch). If this option is not enabled, the Boot-Time Defragmentation operation pauses a short 15 seconds (to allow you to read any messages on the monitor screen), then automatically restarts your computer.

Produce the summary log file

Use this option to cause a text file to be written that summarizes the Boot-Time Defragmentation operation. When this option is enabled, a default volume letter, directory, and file name are shown in the dialog box similar to this:



By default, the summary file is written to your floppy drive (A:). This dialog box can be edited to specify another volume, directory path, and filename. However, the summary file cannot be written to the volume upon which you are running Boot-Time Defragmentation. Also note that the filename should not contain any spaces.

Note: Some computers read the floppy drive at boot-time. We therefore recommend not writing the summary file to the A: drive, unless no other volumes are available.

Run Boot-Time Defragmentation even if this volume is being used by remote users

When this option is set, the computer will force a reboot at the scheduled date and time, if the **Run Boot-Time Defragmentation based on a scheduled time** option has been selected, regardless of whether or not anyone is logged on to the machine. Users who are logged on will be notified at regular intervals, starting one hour before the scheduled reboot, to give them an opportunity to log off.

If this option is cleared, a scheduled reboot will not occur at the scheduled date and time if one or more users are still logged on when the reboot due. In that case, the Boot-Time Defragmentation will occur the next time the machine is rebooted manually.

OK

Click **OK** to save any changes to the Boot-Time Defragmentation properties on the selected volumes and close the Volume Properties console. Boot-Time Defragmentation will be run as scheduled on any volumes that are specified.

Apply

Click **Apply** to save any changes to the Boot-Time Defragmentation properties on the selected volumes without closing the Volume Properties console. When Boot-Time Defragmentation has been enabled on a volume, it will be noted in the Computer pane of the Boot-Time Defragmentation Properties dialog and the main Diskeeper console.

Cancel

Click **Cancel** to close the Boot-Time defragmentation dialog box without making any changes.

Manual Defragmentation Mode

The Manual Defragmentation mode allows you to manually analyze and defragment your volumes. You have direct control over which volumes are analyzed and defragmented, when the analysis or defragmentation is started and stopped, and other Manual Defragmentation properties.

There are several ways by which to start Diskeeper manually, but the most direct method is simply to highlight the volume you want to defragment, then click the **Defragment** button below the Computer pane. Alternatively, right-click a volume and select **Defragment**.

Tip: You can also use the **Defragment** button to start defragmenting the selected volume.

When a manual analysis or defragmentation is running, a Manual Job Report dialog is opened, showing the progress and results of the operation. Use the Volume Map and Job Report tabs to view details about the analysis or defragmentation job.

To stop a manual analysis or defragmentation operation, first highlight the volume on which you want to stop the operation, then either click the **Stop** button on the Diskeeper toolbar or right-click the volume and select **Stop**.

Note that if you exit from Diskeeper (or even log off your computer) while manual defragmentation is running, the operation will continue running until it is complete.

As an option, you can enable I/O Smart to lessen the negative performance impact when manual defragmentation runs. This option is available via the Manual Defragmentation Properties dialog. To view and edit the Manual Defragmentation Properties, click the **Manual Defragmentation Properties** button in the toolbar, or click the **Analyze and Defragment Now** task group in the Quick Launch pane and select **Manual Defragmentation Properties**.

Manual Job Report

The Manual Job Report is displayed as a separate window when you manually analyze or defragment a volume. Within the Manual Job Report are two tabs: The Volume Map tab and the Job Report tab.

Volume Map Tab

The horizontal bars in the Volume Map give a graphic representation of the fragmentation of your volume. The Volume Map displays information for a single volume at a time. The disk highlighted in the Computer pane is the disk shown in the Volume Map.

You can choose between views representing either the degree of fragmentation as it relates to file performance, or the file structure on the volume. You can switch between these two views with the **Volume Map view:** option shown at the top of the Volume Map tab.

The **File Performance** view shows the fragmentation on your volume with an emphasis on the performance impact of that fragmentation. In this view, a file is shown as fragmented only if that fragmentation is affecting the performance of your computer.

The **File Structure** view shows additional detail, including the paging file (if it exists) and other system files like the MFT on NTFS volumes. It also shows all the fragmentation (even fragmented file that are not affecting your system's performance).

What the Colors Mean

After running a manual analysis or defragmentation job, the horizontal bars in the Volume Map give a graphic representation of the fragmentation of your volume. The colors of the display indicate the type and condition of the data on your volume. The colors represent different aspects of your volume when you are viewing the two different Volume Map views available.

When the **File Performance** view is displayed, the colors available are:

- **Dark blue** areas show high-performing files and folders.
- **Red** areas show low-performing files and folders.
- **Pink** areas show low-performing system files.
- **White** areas show free space on the volume.
- **Green/White** striped areas show space on the volume reserved for expansion of the MFT. This space is reserved when a volume is formatted, and cannot be used by applications, including Diskeeper. However, the operating system will write files to this area when the volume becomes extremely full and no other free space is available. Windows provides the capability for Diskeeper to move files out of this reserved area, but does not allow Diskeeper to move files into it. These areas appear only on NTFS volumes.

When the **File Structure** view is displayed, the colors available are:

- **Dark blue** areas show contiguous (non-fragmented) files.
- **Red** areas show fragmented files.
- **Yellow** areas show the paging file if it exists on the volume.
- **Green** areas show unmovable system files. Green areas primarily show the Master File Table (MFT), as well as several other unmovable files. These files cannot be moved safely by Diskeeper (or any other defragmenter), except at boot-time. Keep in mind, however, although these areas are referred to as "system files", these are not the files that make up the operating system (which Diskeeper can

successfully defragment in the Manual or Automatic Defragmentation modes). Instead, they make up the NTFS file system. The green areas of the display appear only on NTFS volumes.

- **White** areas show free space on the volume.
- **Green/White striped** areas show space on the volume reserved for expansion of the MFT. This space is reserved when a volume is formatted, and cannot be used by applications, including Diskeeper. However, the operating system will write files to this area when the volume becomes extremely full and no other free space is available. Windows provides the capability for Diskeeper to move files out of this reserved area, but does not allow Diskeeper to move files into it. These areas appear only on NTFS volumes.
- **Light blue** areas show the directory folders on the volume (and their fragments).

You can also save the Volume Map (as a bitmap file) or print it by using the respective buttons on the Volume Map tab.

Job Report Tab

The Job Report tab shows detailed information about a volume after it has been analyzed or defragmented. The Job Report displays information for a single disk volume at a time.

You can save the Job Report (as a text file) or print it by using the respective buttons on the Job Report tab.

The Job Report tab includes these sections:

Findings and Recommendations Section

This section of the Job Report contains recommendations for improving or maintaining the performance of the volume.

Health Section

This section of the Job Report includes an evaluation of the overall health of the volume, the reasons for that rating, and recommendations for improving or maintaining the reliability of the volume.

Diskeeper Corporation has done extensive research into the causes of disk performance and reliability problems. This research has shown these factors play a significant role in regards to disk performance and reliability—the overall health of a disk volume:

- Overall fragmentation
- MFT fragmentation
- Paging file fragmentation
- Available free space

Diskeeper uses these factors to determine a volume health index each time it analyzes or defragments a volume.

Volume health is rated into three categories—Healthy, Warning and Critical.

This table shows the Warning and Critical levels used in determining the reliability index.

Reliability Factor	Warning Level	Critical Level
Overall Fragmentation	> 10% fragmentation	> 50% fragmentation
MFT Fragmentation	> 250 fragments	>2000 fragments
Paging File Fragmentation	> 250 fragments	>1500 fragments

Free Space	< 15% free space	< 5% free space

Access Time Section

This section of the Job Report displays a graph illustrating the performance characteristics of the volume, based on current read times calculated by Diskeeper—both for all the files on the drive and for only the fragmented files on the volume. It also shows the expected optimum read time for all the files and for only the fragmented files. This gives you a detailed picture of your performance losses due to fragmentation, and the expected improvement you will see after defragmentation.

Each time you analyze or defragment a disk, Diskeeper calculates the read time of the disk in two ways. First, it shows the predicted time to read all the files on the disk. Secondly, it shows the time to read only the fragmented files. Additionally, it determines the optimum (fastest) read time potential for the disk.

It should be noted that by default, the performance analysis is based on pre-determined disk performance values measured as a part of disk performance research done by Diskeeper Corporation. To get a more accurate performance measurement of your actual disks, Diskeeper must scan your drives to measure their performance. Since this measurement can briefly slow down your computer, this scan operation is disabled by default, but you can turn it on easily. The **Enable volume performance data collection** option is described in the **Diskeeper Configuration Properties** section on page 35.

Statistics Section

This section of the Job Report shows useful information about your volume after either analysis or defragmentation. Note that most of the information shown here can also be recorded in the Diskeeper Event Log.

Volume Size

This section of the Job Report or event log entry shows the total amount of space on the disk volume. This includes files and free space, as well as disk space used by the operating system (such as directory files and the Master File Table) but not reported in “Used Space.”

Cluster Size

This section of the Job Report or event log entry shows the cluster size for the volume. A disk cluster represents a number of disk sectors treated as a single unit. The entire disk is divided into clusters, each one a minimum increment of storage.

Used Space

This section of the Job Report or event log entry shows the total amount of space (in kilobytes) currently occupied by files on the volume. This does not include zero-length files, or certain files used by the operating system, such as directory files and the Master File Table.

Free Space

This section of the Job Report or event log entry shows the total amount of free space on the volume.

Percent Free Space

This section of the Job Report or event log entry shows the percentage of the total space on the volume that is free. This includes the free space in the area reserved for the Master File Table (MFT) on NTFS volumes.

Volume Fragmentation

This section of the Job Report or event log entry shows the overall percentage of fragmentation on the volume.

The Volume fragmentation figure gives you an overall view of the fragmentation on your volume, by taking both the file fragmentation level and the free space fragmentation level into account. These two values are weighted depending on the ratio of free space to used space on the disk. The formula is:

*Fragmented space on the volume * 100 / Total space on the volume*

Where *Fragmented space on the volume* is the summed cluster count of all fragmented files times the bytes per clusters.

Data Fragmentation

This section of the Job Report or event log entry shows the percentage of file fragmentation on the volume.

Data fragmentation is calculated like this:

*Volume Fragmentation * Total Space on the Volume / Used Space on the volume*

Note: The calculations are for both Data fragmentation and Volume fragmentation are done based on the uncompressed size of the files. If a volume has a large number of fragmented compressed files, these values can exceed 100%. This is similar to looking at files in Windows Explorer—if a large number of files are compressed, the total size of the data can exceed the volume size. This is why you can sometimes compare the volume size in Disk Management to the total number of bytes on a volume, and they don't "add up".

Total Directories

This section of the Job Report or event log entry shows the total number of directory folders present on the volume.

Fragmented Directories

This section of the Job Report or event log entry shows the number of fragmented directories on the volume.

Excess Directory Fragments

This section of the Job Report or event log entry shows the total number of directory fragments on the volume. Contiguous directories are not counted in this total, but each additional piece of any fragmented directory is counted.

Total Files

This section of the Job Report or event log entry shows the total number of files on the volume. This number does not include zero-length files or (in most cases) files less than one cluster in size on NTFS volumes. Files less than one cluster in size *may* be included, depending on the file size and the cluster size.

Average File Size

This section of the Job Report or event log entry shows the average size of all the files on the volume. This number does not include any zero-length files or paging files.

Total Fragmented Files

This section of the Job Report or event log entry shows the total number of fragmented files on the volume.

Total Excess Fragments

This section of the Job Report or event log entry shows the total number of file fragments on the volume. Contiguous files are not counted in this total, but each additional piece of any fragmented file *is* counted.

Average Fragments per File

This section of the Job Report or event log entry shows the average number of fragments per file on the volume. This is a good index of how fragmented the files on the volume are.

If the average fragment per file figure is 1.00, the files are contiguous. If the figure is 1.10, then 10% of the files, on average, are in two pieces. 1.20 means 20%, 1.30 means 30%, etc. A figure of 2.00 means the files average two fragments each. 1.00 is the best figure attainable, indicating that all files or nearly all files are contiguous.

Files with Performance Loss

This section of the Job Report or event log entry shows the number of files for which fragmentation is causing a loss in performance. For example, although it is fragmented, a large file in two pieces will not exhibit any significant performance loss, so it would not be included in this figure.

Paging/Swap File Size

This section of the Job Report or event log entry shows the size of the paging file on the volume. This section displays zero when no paging file is present.

Total Fragments

This section of the Job Report or event log entry shows the number of fragments the paging file is broken into (if it exists on the volume).

Total MFT Size

This section of the Job Report or event log entry shows the size of the Master File Table (MFT) on the volume.

Since the MFT is only used on NTFS volumes, this section is not displayed for FAT volumes in the text analysis display, and shows as zeros in the event log.

MFT Records in Use

This section of the Job Report or event log entry shows the number of individual file records found in the Master File Table (MFT) on the volume. This figure will not necessarily correspond with the number of files presently on the volume, since the file records remain in the MFT, even after a file is deleted.

Since the MFT is only used on NTFS volumes, this section is not displayed on FAT volumes.

Percent of MFT In Use

This section of the Job Report or event log entry shows the percentage of the Master File Table (MFT) in use on the volume.

The MFT grows as the number of files on the volume increases, but is not reduced in size when files are deleted from the volume.

Since the MFT is only used on NTFS volumes, this section is not displayed on FAT volumes.

Total MFT Fragments

This section of the Job Report or event log entry shows the number of fragments the Master File Table (MFT) on the volume is broken into.

Since the MFT is only used on NTFS volumes, this section is not displayed on FAT volumes.

Most Fragmented Files

Click the **View** button in the Most Fragmented Files section of the Job Report tab to see a list of the most fragmented files on the volume. For each fragmented file listed, this listing shows:

Fragments

Shows the number of fragments associated with the most fragmented files on your disk volume.

File Size

Shows the size of the most fragmented files on your disk volume.

File Name

Shows the names of the most fragmented files on your volume.

If these files are ones that users access frequently, the impact to your system performance may be worse than indicated by the Average Fragments per File figure.

In addition to the names of the most fragmented files, the Most Fragmented Files report also shows information explaining reasons why certain files were not moved or defragmented. The following “tags” may be added to specific filenames in the Most Fragmented Files listing:

Tag	Displayed After	File System	Description
[Cannot Open]	Defragmentation Only	NTFS and FAT	This file cannot be opened (and thus moved) by Diskeeper. This is often the result of the access controls (permissions) on the file being set to prevent Diskeeper from accessing it. File permissions must allow SYSTEM to have full control of a file in order for Diskeeper to defragment it.
[Excluded]	Defragmentation Only	NTFS and FAT	This file is listed on one of the Diskeeper exclusion lists. This can be either the user-specified exclusion list or the internal exclusion list.
[Excess Allocation]	Analysis and Defragmentation	NTFS Only	With the NTFS file system, a file can be allocated more clusters than its data is actually using. This most commonly occurs with registry files that have been decompressed. In some cases, files of this type can be defragmented after a system restart
[Partially Defragmented]	Defragmentation Only	NTFS and FAT	This file has been partially defragmented. Its fragments have been reduced in number, but the file is not yet contiguous.

Manual Defragmentation Job Properties

There are several options available to control how Manual Defragmentation Jobs run. These options are available via the Manual Defragmentation Job Properties dialog. To view and edit the Manual Defragmentation Job Properties, click the **Manual Defragmentation Job Properties** button in the toolbar, or click **Analyze and Defragment Now** in the Quick Launch pane and select **Manual Defragmentation Job Properties**.

In addition to showing general information about Manual Defragmentation operations, the Manual Defragmentation Job Properties dialog offers an option to control how Diskeeper uses disk resources when running Manual Defragmentation. The I.O Smart option is described in the following section.

Setting Disk Priority

You can control the amount of disk input/output (I/O) and CPU resources used by Diskeeper for Manual Defragmentation jobs. The Disk Priority option allows you to control the disk priority at which Manual Defragmentation is run.

The Disk Priority option uses I/O Smart technology to “throttle” (suspend) the Manual Defragmentation job whenever disk I/O activity is detected on a disk while it is being manually defragmented. This help keep the defragmentation process transparent to users, no matter how active the disk.

(Also keep in mind that there is no need to worry about priorities or system slows when Diskeeper is run in Automatic Defragmentation mode. InvisiTasking technology ensures Diskeeper keeps your volumes running at their maximum potential, without interfering with other applications and processes on your computer.)

To change the disk priority for Manual Defragmentation jobs, click **Manual Defragmentation Job Properties** in the toolbar, then select **Disk Priorities**. Note the disk priority properties you set will apply to all Manual Defragmentation jobs on all your volumes.

Diskeeper Configuration Properties

Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane to display the Diskeeper Configuration Properties dialog.

The Diskeeper Configuration Properties dialog allows you to view and edit properties that determine how Diskeeper looks and behaves. The different options in the task pane on the left side of the Diskeeper Configuration Properties dialog give you quick access to these options:

- **General** — See version, copyright and customer support information about your copy of Diskeeper.
- **Updates and Upgrades** — Check for newer versions of Diskeeper. See page 31 for more information
- **File Exclusions** — Specify files and folders that you do not want Diskeeper to process. See page 32 for more information.
- **Event Logging** — Specify the information Diskeeper writes to the Event Log. See page 34 for more information.
- **Power Management** — Specify how Diskeeper operates when your computer is running on battery power. See page 35 for more information.
- **Data Collection** — Specify the type of data Diskeeper collects for its performance and historical reports. See page 35 for more information.
- **Proxy Settings** — Specify any proxy settings necessary for Internet connectivity. See page 36 for more information.
- **New Volume Detection** — Specify how Automatic Defragmentation is enabled when new volumes are detected on your computer. See page 36 for more information.

Updates and Upgrades

Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Updates and Upgrades** option. The Updates and Upgrades page offers these options:

- **Check Now**—Use this option to check immediately for a more recent version of Diskeeper.

  If a newer version of Diskeeper is available, you are given the option of downloading it. When the download screen is displayed, click Run this program from its current location to begin installing the update.

  Otherwise, click Save this program to disk to save the Diskeeper update installation package on your computer for later installation. (To install an update stored on your computer in this manner, simply double-click the file you download and follow the instructions displayed.)

- **Check Automatically**—Use this option to allow Diskeeper to automatically check for newer versions on a periodic basis.

File Exclusions

Diskeeper exclusion lists allow you to specify files and directories that will not be allowed to be processed by Diskeeper in the Automatic or Manual defragmentation modes. For example, you might not want to defragment temporary files that will soon be deleted.

Keep in mind that fragmented files that are excluded from defragmentation can “skew” the analysis results displayed in the Job Report tab.

Diskeeper uses two lists — one that you specify, and second “internal” list that you cannot modify. The exclusion list that you create is described below. See page 33 for more information about the Diskeeper Internal Exclusion List.

To open the Diskeeper Exclusion List, click **Diskeeper Configuration Properties** in the Diskeeper toolbar or select **Diskeeper Configuration Properties** from the **Configure Diskeeper** task group in the Quick Launch pane, then select **File Exclusions**. Within this page, you can specify the files, folders and volumes you want to be excluded from Diskeeper processing.

The following controls are available in the File Exclusions dialog:

Note: Wildcard file specifications such as * or ? are allowed.

Volumes

Use this section of the File Exclusions page to choose the volume from which you want to exclude files or directories from defragmentation.

Path

Use this section of the File Exclusions page to choose specific directories to be excluded from defragmentation. Select a directory by highlighting it, and then click **Add Folder** to add the directory to the exclusion list.

When a directory folder is added to the exclusion list, any subdirectories below the directory in the tree are also excluded.

Add Folder Button

Click **Add Folder** to add the selected directory path to the Diskeeper exclusion list.

Files

Use this section of the File Exclusions page to choose specific files (by name) to be excluded from defragmentation. Highlight the file(s) to be excluded, and then click **Add Files** to add the file to the exclusion list.

Add Files Button

Click **Add Files** to add the selected file(s) to the Diskeeper exclusion list.

Exclusion List Box

This box shows the files, directories, and volumes that will be excluded from defragmentation.

Remove Button

Click **Remove** to remove specific files, directories, or volumes from the Diskeeper exclusion list. To remove one or more items from the list, highlight the items in the Exclusion List Box and click **Remove**.

Apply Button

Click **Apply** to save the exclusion list and keep the Diskeeper Configuration Properties dialog open.

OK Button

Click **OK** to save the exclusion list and close the Diskeeper Configuration Properties dialog.

Cancel Button

Click **Cancel** to cancel any changes you have made to the Diskeeper exclusion list and return to the main Diskeeper display.

Help Button

Click **Help** to see the Diskeeper Help discussion about creating an Exclusion List.

Diskeeper Internal Exclusion List

There are certain files that should not be moved under any circumstances. These files may be system files or files related to specific applications. Moving these specific files can cause system or application failure. As a result, Diskeeper uses an “internal” exclusion list to ensure these files are always excluded from Diskeeper processing. This list is fixed in memory and cannot be modified. These are the files that are currently in the Diskeeper internal exclusion list:

Under Windows XP and Windows Vista

- $MFT
- $MFTMIRR
- $LOGFILE
- $VOLUME
- $ATTRDEF
- $BITMAP
- $BOOT
- $BADCLUS
- $SECURE
- $UPCASE
- $HIBERFIL.SYS
- $MEMORY.DMP
- $SAFEBOOT.FS
- $SAFEBOOT.CSV
- $SAFEBOOT.RSV
- $BOOTSECT.DOS

Excluded During Boot Time Defragmentation

- \\$ESSNAP\\SNAPS.SNP
- $SAFEBOOT.FS
- $SAFEBOOT.CSV
- $SAFEBOOT.RSV
- \\BOOT.INI
- \\NTDETECT.COM
- \\NTLDR

- \\NTBOOTDD.SYS
- *\\NTOSKRNL.EXE

Note that these files are not displayed in the Diskeeper user-defined exclusion list. See *Diskeeper won't move some files no matter what I do. Is there a problem with Diskeeper?* on page 41 for more information about the Diskeeper internal exclusion list.

Event Logging

Diskeeper Event Logging records general information about Diskeeper activity in the Windows Application Event Log.

Note: Left in it default configuration, the Windows Application Event log can fill up quickly. See page 5 for information on how to set up the Application Event Log under these operating systems to avoid this situation.

To view or change the Diskeeper Event Logging options, click **Diskeeper Configuration Properties** in the Diskeeper toolbar or select **Diskeeper Configuration Properties** from the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Event Logging** option to open the Event Logging dialog.

The Event Logging dialog displays a list of events for which logging can be enabled or disabled. Use the check boxes for the following options to alternately enable or disable each option:

Service start and stop

When this option is enabled, an entry is made to the Event Log each time the Diskeeper service starts or stops.

This option is enabled by default.

Defragmentation start and stop

When this option is enabled, an entry is made to the Event Log whenever Automatic or Manual Defragmentation starts or stops. The Event Log entry for this option also includes information about files that cannot be moved, either because the files are on a Diskeeper exclusion list, or the files cannot be opened. Common causes preventing a file from being opened include access controls or permissions on the file being set to prevent Diskeeper from accessing it. File permissions must allow SYSTEM to have full control of a file in order for Diskeeper to defragment it. See page 43 for more information about setting access permissions.

This option is enabled by default.

Volume information

When this option is enabled, an entry is made to the Application Event Log at the end of each defragmentation run showing general information about the volume that was defragmented. This appears in the Windows Event Viewer as Diskeeper Event 15. This option is not enabled by default.

For a description of information contained in the Description box, see page 27.

File information

When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the files on the volume that was defragmented. This appears in the Windows Event Viewer as Diskeeper Event 16. This option is not enabled by default.

For a description of information contained in the Description box, see page 27.

Paging File information

When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the paging file on the volume that was defragmented (if it exists on the volume). This appears in the Windows Event Viewer as Diskeeper Event 17. This option is not enabled by default.

For a description of information contained in the Description box, see page 27.

Directory information

When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the directories on the volume that was defragmented. This appears in the Windows Event Viewer as Diskeeper Event 18. This option is not enabled by default.

For a description of information contained in the Description box, see page 27.

MFT information

When this option is enabled, an entry is made to the Event Log at the end of each defragmentation run showing information about the Master File Table (MFT) on the volume that was defragmented. (Keep in mind, since only NTFS volumes have an MFT, this information will only apply to NTFS volumes.) The entry appears in the Windows Event Viewer as Diskeeper Event 19. This option is not enabled by default.

For a description of information contained in the Description box, see page 27.

Power Management

The Diskeeper Power Management option controls how Diskeeper operates when the computer is running on battery power.

To enable this option, click **Diskeeper Configuration Properties** in the Diskeeper toolbar or select **Diskeeper Configuration Properties** from the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Power Management** option to control the how Diskeeper operates on computers running on battery power, and to control Diskeeper behavior when Microsoft Volume Shadow Copy Service (VSS) is enabled on a volume.

Power Management

When this option is enabled and the computer switches from normal power to battery power, any ongoing Automatic Defragmentation is safely postponed and a message noting this is written to the Windows Application Event Log. A message is also displayed informing you that Automatic Defragmentation has been postponed. When the computer switches back to normal power, Automatic Defragmentation will resume.

When this option is enabled and the computer is running on battery power, any ongoing Manual Defragmentation jobs are cancelled. and a message noting this is written to the Windows Application Event Log. If you start a Manual Defragmentation job when this option is enabled (and the computer is running on battery power), a message is displayed asking if you want to continue, even though running Diskeeper on battery power may reduce the available battery time.

Data Collection

Diskeeper can provide useful information about file performance loss on your volumes, and also historical data about the fragmentation levels on your volumes. To do this, Diskeeper relies on performance and defragmentation data collected from your volumes.

To control the data collection properties of Diskeeper, click **Diskeeper Configuration Properties** in the Diskeeper toolbar or select **Diskeeper Configuration Properties** from the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Data Collection** option. Within the Data Collection dialog, you are presented with these options:

Enable volume performance data collection

By default, Diskeeper uses pre-determined disk performance values when calculating your performance loss due to fragmentation. To get a more accurate picture of the performance of your volumes, Diskeeper can perform a performance data scan of all your hard drives.

Use the **Enable volume performance data collection** option to enable or disable the scanning of your volumes to gather volume performance data.

Diskeeper uses the data gathered during the performance data scan to measure the performance of each of your volumes. It uses this information to determine how much performance you are losing due to fragmentation, and shows the results in the Job Report tab when you run an analysis or defragmentation.

Allowing this scan to take place improves the accuracy of the performance data displayed by Diskeeper after the analysis or defragmentation of a disk. When this option is disabled, Diskeeper uses default disk performance values when calculating your performance loss due to fragmentation.

This performance scan may take several minutes to complete and may temporarily slow down your computer, but only while the scan is running.

Enable volume fragmentation data collection

In order to provide accurate information in the History and Log tabs, Diskeeper must analyze your volumes daily and save that data to a data file.

Use the **Enable volume fragmentation data collection** option to enable or disable the daily analysis of your volumes to gather fragmentation data.

Proxy Settings

Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or select **Diskeeper Configuration Properties** from the **Configure Diskeeper** task group in the Quick Launch pane, then select the **Proxy Settings** option to control the following options:

Proxy Settings

Diskeeper relies on an Internet connection to check for product updates and upgrades, and in some cases for product activation. If you use proxy settings to connect to the Internet, use the controls provided to specify the proxy address and port for your connection.

Permissions

If your proxy server requires authentication, use these controls to enter a user name and password with appropriate permissions for proxy access.

New Volume Detection

Click **Diskeeper Configuration Properties** in the Diskeeper toolbar or select **Diskeeper Configuration Properties** from the **Configure Diskeeper** task group in the Quick Launch pane, then select the **New Volume Detection** option to control the following option:

Enable Automatic Defragmentation on all volumes automatically

Enable this option to allow Diskeeper to automatically enable Automatic Defragmentation on any new volumes it detects. This is useful for cases where you have removable USB drives, memory cards, or other storage media that appear to windows as a disk volume.

Chapter 5

Theory of Operation

This chapter describes the original Diskeeper design goals and how those goals were met.

Introduction

As described in the introduction of this manual, the term *disk fragmentation* means two things:

- a condition in which pieces of individual files on a disk are not contiguous, but rather are broken up and scattered around the disk volume; and
- a condition in which the free space on a disk volume consists of little pieces of space here and there rather than a few large free spaces.

The effects of excessive fragmentation are twofold as well:

- file access takes longer because a file must be collected in pieces here and there, requiring several disk accesses instead of just one; and
- file creation takes longer because space for the file must be allocated in little pieces here and there instead of just one contiguous allocation.

Before the introduction of Diskeeper, there was no method for completely correcting the problems of file and free space fragmentation on Windows NT® (and later) computers or in a Windows network.

Design Goals

In designing Diskeeper for Windows, the following goals were established:

- The product must be completely safe to use.
- It must improve Windows system performance. It is not designed to make the disk look “pretty”—it is designed to improve disk performance and, as a result, overall system performance.
- It should process live disks without interfering with user access to files.
- It should run without operator intervention.
- It must defragment all possible files and consolidate free space into the smallest possible number of large spaces.

Diskeeper defragments files and free space on a disk, allowing access to the files on the disk at any time while Diskeeper is running.

Safety

Diskeeper is designed with *safety* as the highest priority.

To ensure the safe movement of files, Diskeeper uses mechanisms built into the operating system that were developed and implemented by Diskeeper Corporation (then known as Executive Software), and fully incorporated into Windows 2000, Windows XP, and Windows Server 2003 by Microsoft.

By using these built-in mechanisms, Diskeeper maintains cache coherency, file security and permissions information, and file content integrity no matter how fragmented the files on the disk are.

The foremost design goal for Diskeeper is to make sure that no data is ever lost. To accomplish this goal Diskeeper uses the following criteria for accessing files:

- the contents of data files are never modified under any circumstances
- only one file is processed at a time, not the whole disk
- no information is stored on any other device or in a “scratch space”
- Diskeeper accesses a file in such a way that no user access can conflict with Diskeeper during the critical portion of the relocation process
- file relocation is aborted if any error is encountered, leaving the file in its original state

Diskeeper was designed to err on the side of caution. In other words, it only moves a file on the volume when it is absolutely certain that no data will be lost, including file attributes. The only change to file attribute-type information is the physical location of the file on the volume. None of the file dates are changed and no other fields in the file record header are used to store Diskeeper information.

Diskeeper never defragments or moves files that are specifically stored at a specific physical location on the volume.

If anything causes your computer to crash while Diskeeper is running, or if you abort the Diskeeper defragmentation run in the middle of the file relocation process, no data is ever at risk.

Performance

When running in the Automatic Defragmentation mode, Diskeeper is designed to run in the background, without adversely affecting performance of your Windows computer. The exclusive InvisiTasking technology ensures Diskeeper keeps your volumes at peak performance without negatively impacting system performance while it is running. Diskeeper was designed in such a way to ensure it will not interfere with other processes on your Windows computer.

Process Live Disks

It is not acceptable to force users off the disk while performing routine defragmentation. To do so would be a case of the cure being worse than the disease. Access to fragmented files is better than no access at all.

The best solution is to defragment online with users active on the same disk volume. Diskeeper was designed with this in mind. During most of the time Diskeeper is processing a file, it shares the file with any other users that may access the same file. The last step of processing the file, however, involves locking the file for a very brief period, a matter of milliseconds. If another user requests a file that Diskeeper has locked, that request is suspended for the brief period until Diskeeper releases the file. Then the request is serviced. There is never an interruption of either process as a result of this delay.

This solution allows Diskeeper to defragment open files safely, regardless of whether they are open for read operations or for write operations.

No Operator Intervention

In keeping with the design goals, after Diskeeper has been started in the Automatic Defragmentation mode, it runs automatically in the background, without the need for operator intervention. It runs indefinitely, unless told otherwise by you.

Appendix A

Table of Diskeeper Editions

The table below shows the different editions of Diskeeper available, as well as the features and capabilities of each:

	Diskeeper 2007 Editions					
	Home	Professional	Pro Premier	Server	EnterpriseServer	Administrator
Defragmentation	✓	✓	✓	✓	✓	N/A
Performance Analysis	✓	✓	✓	✓	✓	N/A
Reliability Analysis	✓	✓	✓	✓	✓	N/A
Fragmentation Analysis	✓	✓	✓	✓	✓	N/A
Automatic Defragmentation	✓	✓	✓	✓	✓	N/A
Boot-Time Defragmentation	✓	✓	✓	✓	✓	N/A
Efficient Defragmentation of Large Files		✓	✓	✓	✓	N/A
Comprehensive Defragmentation		✓	✓	✓	✓	N/A
Improved Free Space Consolidation		✓	✓	✓	✓	N/A
Exclusion List	✓	✓	✓	✓	✓	N/A
Event Logging	✓	✓	✓	✓	✓	N/A
Adjustable Priority		✓	✓	✓	✓	N/A
I/O Smart (Disk I/O Throttling)	✓	✓	✓	✓	✓	N/A
Frag Shield Paging File and MFT Configuration		✓	✓	✓	✓	N/A
I-FAAST 2.0 (Intelligent File Access Acceleration Technology)			✓	✓	✓	N/A
Command Line Interface		✓	✓	✓	✓	N/A
Maximum Single Volume Size Supported	768 GB	768 GB	2 TB	2 TB	No limit	N/A
Total Disk Space Supported (all volumes)	No limit	No limit	No limit	No limit	No limit	N/A
Terabyte Volume Engine (TVE 2.0)					✓	N/A
64-bit Processor Compatible	✓	✓	✓	✓	✓	N/A
Support for 64-bit Operating Systems		✓	✓	✓	✓	N/A
Allows Control by Diskeeper Administrator		✓	✓	✓	✓	N/A
Group Policy Support		✓	✓	✓	✓	N/A
Remote Control of Local Diskeeper Editions						✓

This table shows the different Diskeeper editions available and the Windows operating systems they support:

	Diskeeper 2007 Editions					
	Home	Professional	Pro Premier	Server	EnterpriseServer	Administrator
Windows 2000 Professional	✓	✓	✓	✓	✓	✓
Windows XP Home	✓	✓	✓	✓	✓	
Windows XP Tablet PC	✓	✓	✓	✓	✓	
Windows XP Media Center	✓	✓	✓	✓	✓	
Windows XP Professional	✓	✓	✓	✓	✓	✓
Windows XP Professional for x64		✓	✓	✓	✓	✓*
Windows Vista Home Basic	✓	✓	✓	✓	✓	
Windows Vista Home Premium	✓	✓	✓	✓	✓	
Windows Vista Ultimate	✓	✓	✓	✓	✓	✓
Windows Vista Business		✓	✓	✓	✓	✓
Windows Vista Enterprise		✓	✓	✓	✓	✓
Windows Vista Home Basic x64		✓	✓	✓	✓	
Windows Vista Home Premium x64		✓	✓	✓	✓	
Windows Vista Ultimate x64		✓	✓	✓	✓	✓*
Windows Vista Business x64		✓	✓	✓	✓	✓*
Windows Vista Enterprise x64		✓	✓	✓	✓	✓*
Windows 2000 Server				✓	✓	✓
Windows Server 2003 Web				✓	✓	✓
Windows Server 2003 Standard				✓	✓	✓
Windows Server 2003 Standard for x64				✓	✓	✓*
Windows Server 2003 Enterprise				✓	✓	✓
Windows Server 2003 Enterprise for x64				✓	✓	✓*
Windows Server 2003 Enterprise (Itanium)					✓	
Windows 2000 Advanced Server				✓	✓	✓
Windows 2000 Datacenter Server					✓	✓
Windows Server 2003 Datacenter Server					✓	✓
Windows Server 2003 Datacenter Server (Itanium)					✓	
Windows Storage Server 2003				✓	✓	
Windows Server 2003 w/Server Appliance Kit				✓	✓	
Windows 2000 w/Server Appliance Kit				✓	✓	

* Diskeeper Administrator installs and runs only in "compatibility mode" on x64 systems

Appendix B

Answers to Frequently Asked Questions

Does Diskeeper work with Windows XP Service Pack 2?

Yes. However, if you are installing or running Diskeeper on a computer running Windows XP Service Pack 2 (SP2), be sure to visit **http://www.diskeeper.com/sp2** for the latest information about running Diskeeper with SP2. Note that this information also applies to Windows Server 2003 SP1.

Why won't my volume defragment completely?

This can be the result of several situations. If your volume is extremely full, there may not be sufficient free space to defragment the files completely. In that case, we recommend temporarily moving some of the files off the volume, particularly large files. This temporary measure often allows Diskeeper the "working room" it needs to complete the defragmentation process. It also allows Diskeeper to defragment the free space on the volume, increasing the possibility that the temporarily-moved files can be moved back to the volume in a contiguous or less fragmented condition.

Another cause of incomplete defragmentation is a fragmented paging file. For more information, see *Can Diskeeper defragment paging files?* on page 42.

A volume that, at some time, has been filled to capacity may have a severely fragmented Master File Table (MFT). Volumes that have been converted from FAT to NTFS often also have a fragmented MFT. A White Paper describing the causes and effects of MFT fragmentation is available from the Diskeeper Corporation website at **http://www.diskeeper.com/products/documentation/documentation.asp**. Use the Boot-Time defragmentation option to defragment a fragmented MFT. For more information, see page 21.

Another situation that can prevent complete defragmentation of a volume is the existence of a large number of directories on the volume. For more information, see *Can Diskeeper move directories?* on page 42.

Yet another cause for incomplete defragmentation can be a security access situation. Both SYSTEM and ADMINISTRATOR must have full control over a file (or the directory folder it is in) in order for Diskeeper to have access to move the file. This is because the Diskeeper service runs under the Administrator account, and System access is necessary to defragment files safely. This security feature is governed by the Windows C2 security requirements. Included with Diskeeper is a batch file that sets the access permissions on a disk volume to allow Diskeeper to run properly. See page 43 for information about using this batch procedure.

Diskeeper won't move some files no matter what I do. Is there a problem with Diskeeper?

Diskeeper has a built-in list of files that it will not move under any circumstances. This list is referred to as the Diskeeper internal exclusion list.

The most common reason for a file existing on the Diskeeper internal exclusion list is safety. The file cannot or should not be moved in order to maintain the integrity of your system.

For example, the file memory.dmp is on the Diskeeper internal exclusion list. This file is on the exclusion list because the disk locations where this file is stored are loaded by the kernel when the system boots and stored in memory. These disk locations are then used to write the dump file should it need writing. If Diskeeper were to move this file, then the system failed, the dump file would be written over other files or in space considered to be free space. This could result in a very corrupted disk.

The same situation applies to hiberfil.sys. When your system goes into hibernation mode, the pre-fetched disk locations are overwritten with the hibernation data. If Diskeeper moved hiberfil.sys out and moved other files into those disk locations, then disk corruption would occur.

Why doesn't Diskeeper move all of the files into one place on the volume?

Our primary philosophy with Diskeeper is improving and maintaining the performance of your computer. The disk drives are the primary bottleneck in your computer's performance. Diskeeper restores the disks to top speed by eliminating fragmentation.

It is a common misconception that a defragmented disk should look very neat and tidy in the Volume Map tab, with solid blue bars all the way across the screen (representing fragmentation-free files) and the rest white space (representing consolidated space).

Clearly, the speed of the volume (meaning how fast you can access the data on it) is more important than the prettiness of the display or the consolidation of all the free space into one place. Free space consolidation might be important if the next file that you plan to create needs to be one gigantic contiguous file, but it has no effect on performance. In fact, the operating system may or may not write the next file into a contiguous location—even if there is a large enough space.

Because of this, when using the “Quick” or “Recommended” defragmentation methods, Diskeeper uses algorithms that achieve the highest speed from your volumes regardless of the arrangement of the free spaces on the disk and on the screen—and it does so without wasting time on excessive consolidation of free space. We simply go for the fastest possible file access times and then stop.

Even so, you might ask why we don't continue and rearrange the files further to get a neat display? Because it takes computer power to do so. We long ago decided that it would be wrong for Diskeeper to consume more of your computer's performance than it gives back. So Diskeeper defragments until the disk is in top shape performance-wise and then stops.

Now this might not be important to you if you like to sit and watch the display as Diskeeper defragments your drive, but it is a very big deal to large corporate data centers and people who depend on their computers for their work. They need all the performance they can get and can't hold up production while the defragmenter works to enhance the “look” of the disk but not improve its performance. This is why Diskeeper is designed to run automatically in the background, giving way to any other program that needs to run. And it is also why Diskeeper stops defragmenting when maximum performance has been achieved.

Can Diskeeper move directories?

On NTFS volumes on Windows 2000, Windows XP, and Windows Server 2003 systems, Diskeeper can safely move and defragment directories when running in both Automatic and Manual defragmentation modes. Diskeeper also consolidates directories for additional performance gains.

Can Diskeeper defragment paging files?

Diskeeper does not defragment active paging files, since paging files must be open for exclusive use by Windows at all times. However, Diskeeper can defragment paging files safely when your computer is being started—a time when the operating system has not yet taken full control of the files and directories on your disk. For more information about defragmenting paging files, see page 21.

Can Diskeeper defragment the Master File Table?

The Master File Table (MFT) is the area on an NTFS disk volume where Windows 2000, Windows XP, and Windows Server 2003 keep the necessary information for retrieving files from the disk volume. The MFT also contains information such as file creation, modification, and backup dates and times. Because the MFT is held open for exclusive use by Windows, Diskeeper does not move any pieces of this critical system file while Windows is running, but can do so safely at boot-time. For more information, see page 21.

Why doesn’t Diskeeper completely consolidate the free space on my volume?

Several factors can prevent the free space on a volume from being defragmented:

- A fragmented paging file. For more information, see page 21.
- A large number of directories on the volume. For more information, see “Can Diskeeper move directories?” on page 42.

On NTFS volumes, a portion of the free space on the volume is reserved by Windows for the Master File Table (MFT). For more information, see *Why don't my files get moved to the beginning of the volume?* on page 43.

It is important to know that having all of the free space in a single, contiguous piece provides very little (if any) performance benefit. Free space fragmented into hundreds of pieces will impact disk performance, but free space that's in a few pieces should not have any effect on the performance of your disk.

Why don't my files get moved to the beginning of the volume?

On NTFS volumes, Windows reserves a portion of the free space on the volume for the Master File Table (MFT). This free space is usually most noticeable at the physical "beginning" of the volume (easily seen using Volume Map tab), but space is also reserved for use by the MFT in other areas of the volume.

Since this space is reserved for exclusive use, Diskeeper will not move files into these areas of the volume, but will move them out of these areas.

Why don't all of my NTFS volumes appear in the Diskeeper Computer Pane?

Both SYSTEM and ADMINISTRATOR must have full control over a file (or the directory folder it is in) in order for Diskeeper to have access to move the file. This is because the Diskeeper service runs under the Administrator account, and System access is necessary to defragment files safely. This is a security feature governed by the Windows C2 security requirements.

If the root-level directory folder does not have SYSTEM and ADMINISTRATOR set for full control (as seen in the Permissions section under the Security tab in the Windows Properties dialog box) Diskeeper will not display the disk volume in the Computer pane under some circumstances.

How do I determine how often to run Diskeeper on my volume?

This depends on many factors, including the level of file activity, the sizes and types of files used, and the amount of free space available on the volume. Of course, the best suggestion is to let Diskeeper Automatic Defragmentation automatically monitor the fragmentation levels of your volumes and adjusts the defragmentation to best fit your needs, even as those needs change.

In cases where you are defragmenting your volumes manually, there are no set rules on how often to defragment your disk volumes, but here are some guidelines.

- Disk volumes on busy file servers should be defragmented more often than those on single-user workstations. You may need to run Diskeeper on a server volume as often as every two to four hours to maintain optimum system performance, while on a workstation, you may only need to run Diskeeper once a day or less. As a general rule, the busier the disk—the more often it will need to be defragmented.

- To determine how often to run Diskeeper on your disk volumes, you can use the logging function of Diskeeper to monitor the number of files moved during each Diskeeper run. For information about how files that are moved by Diskeeper are logged, see page 34. In general, if Diskeeper moves fewer than 50 files per run, you are running Diskeeper frequently enough to maintain the performance of your Windows system at an optimum level. If the number of files moved during each run is greater, or is increasing, schedule Diskeeper to run more frequently. (Here again, you can automate this by using Diskeeper in the Automatic Defragmentation mode.)

How do I set access permissions to allow Diskeeper to defragment my files?

In order for Diskeeper to have access to move files on NTFS volumes, both SYSTEM and ADMINISTRATOR must have full control over a file (or the directory folder it is in). This version of Diskeeper includes a batch file that sets the access permissions on a disk volume to allow Diskeeper to run properly. This batch file is called **setdkacls.bat**, and it is located in the directory folder where Diskeeper is installed.

If you find you have made files inaccessible to Diskeeper, or that you have some files inaccessible to Diskeeper, open a command-prompt window, change directory to the Diskeeper installation directory, and type:

```
setdkacls x:
```

where *x:* is the letter name of the disk volume on which you want to change access permissions.

The **setdkacls.bat** procedure automates the following sequence of commands:

```
cd /d x:

cd \

cacls *  /e /t /c /g Administrators:F System:F
```

For more information about the **cacls** command, type **cacls /?** at a command prompt.

This batch procedure will only work if the account you are logged onto has been granted access to the file(s) you are wanting to defragment.

Should I use Diskeeper on RAID arrays?

Yes—Diskeeper supports all levels of software- and hardware-based RAID arrays. RAID arrays are often used to increase system performance. In a RAID array of four disk drives, for example, a file can be accessed up to four times as fast as on a single drive. This is because the file is spread between the four drives, and all four drives can be accessed at the same time, so the file can be retrieved much faster. However, like the files on a single disk drive, these file parts can become fragmented on the individual drives, which reduces the speed advantage of RAID. In fact, the effects of fragmentation can be more obvious in a RAID array than in a single disk drive.

Diskeeper defragments RAID arrays just as it does single disk drives. Diskeeper improves the speed and performance of a RAID environment by eliminating wasteful and unnecessary I/Os from being issued by the file system. In our four-drive array example, it would defragment the pieces of the file on each separate drive as though they were separate files, and as directed by the RAID controller.

Do I need to have the Diskeeper service running all the time?

Yes. **DkService** is the program that actually runs Diskeeper defragmentation. If the Diskeeper service is disabled or not present, you will not be able to run Diskeeper at all.

That said, if you look at the DkService process using Task Manager, you will see that it uses only a few seconds of CPU time each week. The fact that it is running all the time is not going to use up system resources, or cause any problems.

Since installing Diskeeper, the number of disk errors I get has increased. Why is that?

Diskeeper tends to increase disk activity, and just by running, it can make weak points in the system break. In this case, you have some disk error, most likely in the free space where the Windows disk error checking utility (CHKDSK) cannot find it. This by no means indicates a problem with Diskeeper.

Run CHKDSK/R on your operating system volume at least, preferably on all volumes. That should correct any errors. (CHKDSK/F may not correct this issue.)

If CHKDSK itself aborts when it reaches the bad block, it indicates a disk problem which CHKDSK can't handle, and which will likely cause more trouble in the future. You should back up the volume and reformat (or replace) it to prevent the possibility of data loss due to drive failure.

How can I find which version of Diskeeper I have installed?

Open Diskeeper, click the **Action** menu, then select **About**. This tells you which Diskeeper edition, version and build is installed.

What is InvisiTasking?

When running in Automatic Defragmentation mode, Diskeeper uses InvisiTasking technology to perform its work without impacting other processes on the computer. InvisiTasking uses a proprietary technique developed in our research lab to carefully monitor resource consumption on a Windows computer system and inject Diskeeper processing into the unused portions—and *only* into the unused portions. InvisiTasking is so good that it is all but impossible to even detect whether Diskeeper is running. That means Diskeeper can run all the time. It never needs to back off or shut down to reduce overhead, since overhead is already virtually non-

existent. This means no more need for scheduling defragmentation. In fact, scheduling defragmentation *worsens* performance by delaying the improvement that defragmentation brings. Diskeeper with InvisiTasking means a computer performs at peak *all the time, around the clock*, not just for a few minutes after each scheduled defragmentation run.

Why do I see increased CPU usage when Automatic Defragmentation is running?

If you monitor your computer systems' resource usage with a third party application or systems monitoring program, be aware that Diskeeper's Automatic defragmentation with InvisiTasking uses idle, unneeded resources. Therefore a CPU that might normally operate at 40% (thereby wasting 60% of the CPU's potential) will likely have periods of higher activity as Diskeeper leverages that otherwise wasted CPU time to improve your system's performance. Thus, thresholds set in a systems monitoring application may be exceeded and trigger notifications. Since InvisiTasking immediately backs Diskeeper activity when other applications require resources, this of course never impedes the system or other applications.

This information regarding design behavior is intended only to inform you that such events (greater and more efficient use of resources) can be expected and is not an indication of any issue with Diskeeper or your computer. In fact, it signifies that your system is making the most efficient use of resources possible, minimizing any waste of potential productivity.

Appendix C

Support Services

U.S., Asian and Latin American Support Services

Registered users are entitled to 90 days of free e-mail technical support, as well as special upgrade pricing, from Diskeeper Corporation. If you have not yet registered your Diskeeper purchase, register your purchase online via our website at:

http://diskeeper.com/register

Technical support questions can be answered from the Technical Support section of our website at:

mailto:homesupport@diskeeper.com

You can also contact our technical support team by submitting e-mail to them directly from within our website at:

http://diskeeper.com/supportrequest

When your 90-day free support period has expired, you can purchase the support plan which best suits your needs. Diskeeper Corporation offers 24-hour, 7-day support plans. Contact Diskeeper Corporation to find out which support options suit you best.

Diskeeper Corporation's address is:

Diskeeper Corporation
7590 North Glenoaks Boulevard
Burbank, California, USA 91504

European Support Services

Registered users are entitled to 90 days of free e-mail technical support, as well as special upgrade pricing, from Diskeeper Corporation. Our free European technical support is available Monday through Friday during the first 90 days from 8:30 to 17:30. If you have not yet registered your Diskeeper purchase, register your purchase online via our website at:

http://diskeepereurope.com/register.htm

Technical support questions can be answered from the Support section of our website at:

http://diskeepereurope.com/

You can also contact our technical support team via e-mail at:

mailto:tech.support@diskeeper.co.uk

When your 90-day free support period has expired, you can purchase the support plan that best suits your needs. Diskeeper Corporation offers 24-hour, 7-day support plans. Contact Diskeeper Corporation to find out which support options suit you best.

Diskeeper Corporation's address is:

Diskeeper Corporation
Kings House, Cantelupe Road
East Grinstead, West Sussex RH19 3BE
England

Glossary

access: To store *data* on, or retrieve data from, a *disk drive* or other *peripheral device*. See also *file*.

administrator: See *system administrator*.

applet: A small *application* program that is usually built into an *operating system* or a larger application program. For example, the built-in writing and drawing programs that come with *Windows* are sometimes called "applets."

application: A computer *program*, which causes a computer *system* to perform some useful work for the user.

ATA: Advanced Technology Attachment. One of several standard types of *interfaces* used to connect a *disk drive* and a *computer*. See also PATA and SATA.

AutoPlay: A feature of some *Windows* applications on *CD-ROM* that causes the program to start automatically when the CD-ROM is placed in the drive.

background processing: The execution of certain operations during momentary lulls in the primary (foreground) process. An example of a background process is printing while a word processor is waiting for keystrokes.

binary: From Latin "bini," meaning two by two and "ary," meaning of, or pertaining to. Computers use the binary number system, which is a way of counting in which only two *digits* (0 and 1) are used. Contrast with the familiar decimal number system, in which we count with 10 digits (0 through 9).

bit: Short for *binary digit*. The smallest unit of information handled by a computer. Like a light switch, a bit is either on or off, which corresponds to a numerical value of one or zero. Larger numbers are expressed by groups of bits. See also *byte*.

boot: Refers to the initial start-up of a computer, such as when you turn on the computer's power. From the word "bootstrap," indicating the computer "lifts itself by the bootstraps;" that is, it gets itself going.

boot-time: The time during which a computer *boots*; that is, the computer is starting up and the *operating system* has not yet taken over control of the computer.

browser: A software program, such as Microsoft's *Internet Explorer*, designed to locate and view Web pages on the *Internet*. In addition to displaying text, modern browsers also can display pictures and play sounds.

byte: A group of eight *bits*, which can represent a number from zero through 255, a letter of the alphabet, or a variety of other things.

cache: From the French word *cacher*, meaning "to hide." A temporary storage facility designed to speed things up by providing information to software that would otherwise have to be obtained from a slower *medium*. Caches exist for Web browsers, *disk drives* and *CPU*s. See also *cache memory*.

cache coherency: A condition where the *data* contained in the *cache memories* in a computer with multiple processors is kept consistent at all times.

cache memory: In computers, a cache is a small amount of very fast *memory* that is placed close to (or inside) the *CPU chip*, in order to improve performance. The cache memory holds copies of recently accessed *data*. Because computer programs often run the same instructions repeatedly, many times the CPU will find the data it needs in the cache and therefore will run faster because it does not need to access the computer's main memory.

CD-ROM: Compact Disk Read-Only Memory. A stiff plastic disk commonly used by *software* manufacturers to distribute software to customers. As the name implies, the original contents of a CD-ROM cannot be changed.

central processing unit (CPU): The part of the computer hardware that controls the computer's overall operation and performs computations. Most modern CPUs are built into a single *integrated circuit* or *chip*. See also *Pentium, x86*.

chip: See *integrated circuit*.

CHKDSK: A program (supplied with Windows NT, Windows 2000, Windows XP, and Windows Server 2003) that checks the integrity of a disk and corrects disk errors such as lost *clusters*. See also *scandisk*.

client: In a computer *network*, a computer that uses the services of another computer, called a *server*. For example, a client can "ask" a server to provide it with needed data, or to print a file for the client. See also *server, workstation*.

cluster: Smallest addressable unit of space on a disk. A one-byte file will actually use a cluster of disk space. The minimum size of a cluster depends on the size of the disk *volume*. The *FAT file system* allows a maximum of 65,536 clusters per volume, which means that the cluster size on a 64-megabyte disk volume is one kilobyte, while a 128-megabyte volume uses two-kilobyte clusters. Thus, the FAT file system can be very wasteful of disk space on large volumes. The *NTFS* file system does not suffer from this limitation.

COM: Acronym for Component Object Model, a specification developed by Microsoft for building software *components* that can be made into programs or add functionality to existing programs running on Microsoft Windows platforms.

component: A small modular **program.html** that performs a specific function and is designed to work interactively with other components and **application.html**. See also *applet, COM***.**

contiguous: Adjacent; placed one after the other. A contiguous file is not fragmented; that is, it takes up a single "chunk" of disk space. See also *fragmentation, defragmentation*.

control file: A file (**Diskeep.ctl**) used by *Diskeeper* to keep track of and control defragmentation of disk volumes.

controller: A specialized electronic circuit, which serves as an *interface* between a *device*, such as a *disk drive*, and a computer. See also *IDE, SCSI*.

CPU: see *central processing unit*.

data: Information, as processed by a computer. Plural of the Latin word *datum*, meaning an item of information.

database: A collection of related information about a subject, organized in a useful manner that provides a base or foundation for procedures such as retrieving information, drawing conclusions, and making decisions.

datum: Singular of *data*.

defragmentation: The reduction or elimination of *fragmentation*, by making files and/or free disk space more *contiguous*.

device: A machine, such as a printer or a *disk drive*.

digit: From Latin "digitus," meaning finger. Any of the numbers 0 through 9 in the decimal number system, called a digit because people originally used their fingers for counting. Computers use a *binary* number system with only two digits (0 and 1).

directory: A file that contains a catalog of files and other directories stored on a disk, which allows you to organize your files into groups, making them easier to find. Equivalent to *folder*.

directory consolidation: A *Diskeeper* feature which, at *boot-time*, gathers (almost) all *directory* entries on a *volume* into a single area on the disk, instead of scattered in many places. Directory consolidation requires sufficient contiguous free disk space into which the directories can be moved.

disk drive: A *device* containing one or more disks, treated as a unit by a computer.

Diskeeper: A *software* product that increases *system* performance through disk *defragmentation*. It eliminates *resource*-wasting *file fragmentation* safely, by consolidating fragmented files and free space.

diskette: See *floppy disk*.

domain: In *Windows NT, Windows 2000, Windows XP, Windows Server 2003*, and *Windows Vista*™ a group of *workstations* and *servers*, defined by an *administrator*, that share a common directory database and allow a user to log onto any *resource* in the domain with a single user ID and password. Each domain in a network has a unique name.

drive: See *disk drive.*

drive letter: In *Windows* and *MS-DOS operating systems*, the naming convention for *disk drives*, consisting of a letter, followed by a colon. Drives A: and B: are normally reserved for *floppy disk* drives and C: typically indicates the first *hard drive*. See also *volume*.

encrypted file: A file that has been scrambled and made unrecognizable by anyone who does not have the proper "key" to decode it. The Windows Encrypting File System (EFS) allows users to encrypt files and folders on an NTFS volume to prevent access by unauthorized individuals.

event logging: The process of recording audit information when certain events occur, such as *services* starting and stopping, users logging on and off and accessing *resources*. Logged Diskeeper events can be viewed with the *Event Viewer* utility (in Administrative Tools.)

Event Viewer: A utility that is part of the Administrative Tools available in Windows, which permits the viewing of logged events. See also *event logging*.

extended partition: A type of *partition* that permits the limitation of four partitions per disk drive to be overcome. A disk drive may be partitioned into a maximum of four *primary partitions*, or three primary partitions plus an extended partition. One or more *logical drives* may be created within an extended partition.

FAT: See *file allocation table*.

FAT file system: The *file system* used by *MS-DOS* and adapted for *Windows* to store information on disks, which makes use of a *file allocation table*. There are three types of FAT file system. The FAT12 (12-bit) is used on FAT volumes smaller than 16 megabytes in size, such as *floppy disks*—it is not supported by Diskeeper. FAT16 can be found on all versions of Windows from *Windows 95* through *Windows Vista*. Windows Vista, Windows Server 2003, Windows 2000, Windows Me, Windows 98, and the later OSR 2 version of Windows 95 also support FAT32; Windows NT does not.

field: A subdivision of a *record* in a *file*. For example, a record in a customer file may contain a name field, an address field and a phone number field.

file: A complete, named collection of *data*, such as a *program*, a set of data used by a program, or a user-created document. See also *record, field*.

file allocation table (FAT): A table or list maintained by some *operating systems*, to keep track of how *files* are stored on a disk.

file system: The method used by an *operating system*, of naming, *accessing* and organizing *files* and *directories* on a disk. See also *NTFS, FAT file system.*

floppy disk: A removable storage *medium*, consisting of a small magnetic disk made of flexible plastic, housed in a square protective envelope or cartridge. Originally, floppy disks really were "floppy," because they were enclosed in a paper envelope. Also called a *diskette*, which is a better name for the more recent design that uses a stiff plastic cartridge. Contrast with *hard disk.*

folder: A file that contains a catalog of files and other directories stored on a disk, which allows you to organize your files into groups, making them easier to find. Equivalent to *directory*.

formatting: A method of preparing a disk surface for use by placing certain magnetic patterns on it, which are used by the *file system* in storing and retrieving *data*.

fragmentation: The word *fragmentation* means "the state of being fragmented." The word *fragment* means "a detached, isolated or incomplete part." It is derived from the Latin "fragmentum," which in turn is derived from "frangere," meaning "break." So, *fragmentation* means that something is broken into parts that are detached, isolated or incomplete.

gigabyte: A measure of computer storage capacity equal to approximately a billion bytes. A gigabyte is two to the 30th power, or 1,073,741,824 bytes.

graphical user interface (GUI): Pronounced "gooey." A user *interface*, as used in the *Windows operating systems*, which uses a mouse and graphic displays to interact with the user, with the purpose to make the computer system easier to use than other operating systems, such as *MS-DOS*.

GUI: See *graphical user interface*.

hard disk: One or more rigid metal platters, coated with magnetic material. Contrast with *floppy disk*, or *diskette*, which is made of plastic. Also used to refer to the physical unit that makes up a *disk drive*.

hardware: The physical parts of a computer *system*, including *devices* such as printers and *disk drives*. Contrast with *software*.

I-FAAST™: A Diskeeper exclusive, Intelligent File Access Acceleration Sequencing Technology (I-FAAST) improves file access and creation on NTFS volumes by up to 80% (average 10%-20%) above and beyond the improvement provided by defragmentation alone. This is the first industry implementation of "Disk Performance Calibration", the modern evolution of the outdated and inconclusive disk optimization strategies of the past.

InvisiTasking: A proprietary technology developed by Diskeeper Corporation that carefully monitors resource consumption on a Windows computer system and injects Diskeeper processing into the unused portions—and *only* into the unused portions. InvisiTasking is so good that it is all but impossible to even detect whether Diskeeper is running.

I/O Smart: The Diskeeper I/O Smart feature intelligently monitors drive access during defragmentation to ensure top system speed. When this option is selected, Diskeeper will temporarily suspend defragmentation whenever other disk activity needs to occur (I/O throttling). This proprietary technology detects whether or not the disk is busy with other I/O requests and pauses defragmentation to eliminate any potential interference with user or system needs at the "disk" level.

IDE: Integrated Device Electronics. One of several types of *interfaces* between a *disk drive* and a computer, where the *controller* is built into the disk drive, which eliminates the need for a separate controller card in the computer. See also *ATA* and *SCSI*.

integrated circuit: Also called a *chip*. A collection of electronic parts with a specific purpose, built into a single physical package. See also *central processing unit*.

Intel: Manufacturer of *processor chips*, known especially for the *Pentium* and *x86* processors.

interface: The connection and interaction between *hardware*, *software* and/or the user. For example, a disk *controller* provides a physical interface between a computer and a *disk drive*. The keyboard, mouse and display are an interface between a computer and the user.

Internet: A global **network.html** that links millions of **computer.html**. One popular section of the Internet is the World Wide Web, which allows computer users to view text and pictures with the aid of a browser, such as *Internet Explorer*. E-mail (electronic mail) is another popular part of the Internet, which allows computer users to send and receive written messages.

Internet Explorer: A software package developed by Microsoft for browsing the *Internet*, but increasingly used with other applications.

job: A request to have the computer or its *peripherals* perform some activity. In relation to *Diskeeper*, it is a request to have a disk *defragmented*.

log file: A *file* that keeps track of certain events as they occur. *Windows* maintains several log files that can be viewed with the *Event Viewer*.

logical drive: That portion of the space on a *disk drive* that is considered by the *software* to be a single unit. In this context, *logical* means "conceptual." because there is no direct relationship between the name and a physical object. See also *partition, volume*.

long filenames: In the DOS operating system, filenames were limited to a maximum of eight characters, followed by a period and up to three characters to indicate the type of file. This is also referred to as the 8.3 file naming convention. The Windows 98/Me, Windows NT, Windows 2000, Windows XP, and Windows Server 2003 operating systems allow filenames that are over 200 characters long. In addition, these filenames may contain a mixture of upper- and lowercase characters and embedded spaces.

master file table (MFT): On an *NTFS volume*, the master file table is a *file*, which contains information about all other files in that volume. This includes the name of each file, its physical location on the disk, and other information.

media: A collective word for the physical material on which computer-based information is stored, such as a *CD-ROM* or *floppy disk*. Media is the plural of *medium*, but like *data* is often used in the singular form.

medium: See *media*.

memory: The computer's temporary working storage, where *program* instructions and *data* are kept, permitting the *CPU* to process the instructions.

MFT: See *master file table*.

Microsoft: A computer *software* company, with its head office in the state of Washington; creators of the *MS-DOS* and *Windows operating systems*.

MMC: Microsoft Management Console. MMC can be used to create, save and open administrative tools (called *snap-ins*), such as Diskeeper. MMC provides a common user interface for system tools, as well as a system for managing hardware, software and network components.

MS-DOS: Microsoft Disk Operating System. An *operating system* designed for a small computer with a single user running one *application program* at a time.

multitasking: A feature of an *operating system*, where the computer can work on more than one *task* at a time. See also *background processing*.

network: A group of computers that are connected together and capable of exchanging data with each other. See also *server, client*.

NTFS: New Technology File System. A file system designed specifically for use with Windows NT, and carried into Windows 2000, Windows XP, Windows Server 2003.

OEM: Acronym for original equipment manufacturer. The term is misleading, because an OEM typically buys computers from another manufacturer, customizes them for a particular **application.html**, and then sells them under the OEM's own brand name.

operating system: A collection of *programs*, which perform *system* functions and control the running of *application* programs and the allocation of *resources*.

page file or **paging file:** An area of a disk that is set aside to hold *data* intended to reside in the computer's *memory*. Portions of the paging file are copied to memory as needed. This mechanism requires a much smaller amount of physical memory than would be required if the entire *program* were to be loaded into memory all at once. See also *swap file*.

partition: A subdivision of the space on a *disk drive* that is treated as though it were a separate physical unit. A computer with only one hard disk drive can have a single partition, often called drive C:, or it can have several partitions, such as drive C:, drive D:, and drive E:. See also *volume, drive letter, primary partition, extended partition, logical drive*.

PATA: Parallel Advanced Technology Attachment. Originally called *ATA*, but retroactively renamed *PATA* with the introduction of Serial Advanced Technology Attachment (SATA) *interfaces*. One of several methods of interfacing *disk drives* and other *devices* to computers. See also *ATA*, *IDE*, S*ATA* and *SCSI*.

Pentium: The name of a type of *processor*, introduced by *Intel* in 1993. It is the successor to the 80486 and equivalent to the 80586 chip in the *x86* series.

peripheral device: (Related to *periphery*, roughly meaning "on the outside.") A *device*, such as a *disk drive*, printer, keyboard or mouse, connected to and used by a computer.

permission: The ability of a user on a computer *system* to *access* or modify *files*, especially those that he or she did not create. Permissions exist for security reasons, to prevent unauthorized access to sensitive information. The *system administrator* assigns permissions, or "who has access to what."

platform: The environment, in which a computer system operates, either based on the computer's CPU or its operating system. For example: the *x86* platform, or the *Windows Server 2003* platform.

platter: A *disk drive* consists of one or more platters, each of which can receive magnetic recordings on both sides. The platter spins like a phonograph record on a turntable.

primary partition: In *Windows* and *MS-DOS operating systems*, the disk space on a *disk drive* may be divided into a maximum of four primary partitions; or three primary partitions plus an *extended partition*, which in turn can contain one or more *logical drives*.

priority: On a *Windows system*, several *programs* can appear to be running at once, even though the *CPU* can only process one instruction at a time. With the help of the *operating system*, the CPU processes a few instructions from one program, then a few instructions of the next program, and so on, over and over. Without priority assignments, each program would be given about the same amount of time in each "time slot." but by assigning priorities, the more important programs can be given longer time intervals than the less important ones, allowing them to complete faster.

process: A *program*, along with the system *resources* the program requires to run. A process represents a unit of resource ownership and work to be done. The *operating system* creates processes to keep track of resources and to ensure the proper scheduling of *tasks*.

processor: See *central processing unit*.

program: A set of instructions that tell a computer what to do. Synonym: *software*.

RAID: Redundant Array of Independent Disks. A method of combining several *disk drives* to make one large volume. Typically used on a *network file server* to achieve faster *access*, greater protection against disk failure, or both.

record: A collection of related *data* items, treated as a unit. For example, in a *file* containing information about a company's customers, one record would consist of the particulars (name, address, phone number, etc.) of one customer. See also *field*.

registry: A *database* that contains information about current *hardware* settings, installed *software*, user preferences and associations between *file* types, and *applications* that *access* those files.

resource: Any part of a computer system, such as a *disk drive*, printer, or *memory*, which can be used by a *program*.

SATA: Serial Advanced Technology Attachment. A successor to *ATA* (which was later renamed *PATA*). One of several methods of interfacing *disk drives* and other *devices* to computers. See also *ATA*, *IDE*, *PATA* and *SCSI*.

SCSI: Small Computer System Interface. One of several methods of *interfacing disk drives* and other *devices* to computers. See also *ATA*, *IDE*, *PATA*, and *SATAI*.

server: On a computer network, a computer that makes *resources* available to other computers (*clients* or *workstations*.) For example, all the computers on a network can be set up to share a single high-speed printer,

which is connected to the server. Usually, the server is faster and more powerful than the client computers connected to it.

service: A process that performs a specific system function and often provides an application programming interface (API) for other processes to call. *Diskeeper* uses a *Windows* service, which allows Diskeeper to run in the *background* while other applications are running.

Service Pack: A collection of *software* used to issue corrections and updates to software between major releases. Usually refers to compilations of corrections and updates to a Windows operating system.

Set It and Forget It: A term that was created by Diskeeper Corporation, which is a registered trademark and hallmark of the company. A "Set It and Forget It" product can operate transparently (unseen by the user) and in the *background* (concurrent with other *applications*). A Set It and Forget It product runs without further intervention or attention from the user or *administrator*.

SMS: System Management Server. A *software* product from *Microsoft*, which permits the *system administrator* on a Windows NT, Windows 2000 or Windows Server 2003 *network* to do such things as install and run new software on different computers on the network, all from a single location.

snap-in: A program, such as Diskeeper, that can be used with the Microsoft Management Console (*MMC*). For more information, see the MMC Help facility.

software: A generic term for computer *programs*, taken collectively. Contrast with *hardware*. Software can be categorized into *application* software and *system* software.

sparse files: A method of storing large files—that contain mostly empty space and not much data—in a way that uses much less disk space than would otherwise be used. Sparse file support allows an application to create very large files without committing disk space for every byte.

swap file: A *file* on a *disk drive* that *Windows 98*/Me uses to hold temporary *data* that will not fit into *memory*. When needed, the *operating system* moves data from the swap file to memory. See also *paging file*.

system: The collection of one or more computers and *peripheral devices*. Sometimes used as a synonym for *operating system*, or the combination of *hardware* and *software*, as a logical unit.

system administrator: The person in charge of maintaining a multi-user computer *system*.

system file: In general, a *file* that is part of, or *accessed* by, the *operating system*. The Diskeeper Volume Map display shows certain system files in green, particularly the *master file table* (MFT) and several other files that cannot be moved safely by Diskeeper (or any other defragmenter). These are not the files that make up the Windows *operating system*, but the files that make up the *NTFS file system*.

task: A *program* or portion thereof that is run as an independent entity.

terabyte: A measure of computer storage capacity equal to 2 to the 40th power or approximately a thousand billion *bytes* (or a thousand *gigabytes*).

trialware: A free software package from Diskeeper Corporation, such as Diskeeper, that has the same functionality as the official version of the software, but which works for a limited time period, after which it expires. Trialware allows you to try the software before making a buying decision.

utility: A *program* that provides basic services or functions.

volume: A subdivision of the space on a *disk drive* that is treated as though it were a separate physical unit, or a combination of physical disks treated as a single unit. A computer with only one hard disk drive can have a single volume, often called drive C:, or it can have several volumes, such as drive C:, drive D:, and drive E:. See also *drive letter, logical drive, partition*.

volume set: In *Windows*, a single *logical drive*, which is composed of up to 32 areas of free space on one or more *disk drives*. Volume sets can be used to combine small areas of free space on one or more disk drives into a larger logical drive, or to create a single large logical drive out of two or more small disks.

Windows: A family of *operating systems*, first introduced by *Microsoft* in 1983, with a *graphical user interface* and which ran on *MS-DOS* based computers. See also *Windows 95, Windows 98, Windows NT, Windows 2000, Windows XP, Windows Server 2003* and *Windows Vista*.

Windows 2000: Originally named *Windows NT* 5.0, Windows 2000 is a family of operating systems for desktop computers and network servers, announced by *Microsoft* in 1998. Windows 2000 resembled *Windows NT* 4.0 and *Windows 98*, but had many enhancements and new features. Windows 2000 is available in several editions, ranging from Windows 2000 Professional to Windows 2000 Advanced Server.

Windows 95: A version of **Microsoft_Windows.html** released in 1995. New features in Windows 95 with regard to its predecessor, Windows 3.1, included a new user interface and support for 32-bit applications.

Windows 98: Successor to the *Windows 95* operating system, Windows 98 featured support for the *FAT*32 *file system*, greater Internet integration, and support for the latest (at the time) hardware developments.

Windows Me: Short for Windows Millennium Edition, an operating *system* released by *Microsoft* in September 2000. Successor to *Windows 98* and designed for home use, Windows Me offers enhancements in the areas of digital *media*, *user interface*, home *networking*, and the *Internet*.

Windows NT: An *operating system* released by *Microsoft* in 1993 (NT stands for New Technology.) It has a similar *graphical user interface* to *Windows*, but it does not run over *MS-DOS* and was designed specifically for computer *network* environments.

Windows Server 2003: An operating system released by Microsoft in 2003 as the follow-up version to Windows 2000 Server. Like its predecessor, it has a similar graphical user interface to Windows, but it does not run over MS-DOS and has been designed specifically for computer network environments. Windows Server 2003 is available in Standard, Web, Enterprise, and Datacenter editions.

Windows Vista: Previously known by the codename of “Longhorn”, Windows Vista is an operating system expected to be released by *Microsoft* in 2006 or 2007 as the follow-up version to *Windows XP*. It has an updated *graphical user interface* as well as a number of other anticipated improvements. Windows Vista is slated to be available in several editions for corporate and personal use.

Windows XP: An operating system released by *Microsoft* in 2001 as the follow-up version to *Windows 2000*. Like its predecessor, it has a similar *graphical user interface* to other Windows versions, but it does not run over MS-DOS and has been designed specifically for computer network environments. Windows XP is available in several editions for different uses, such as Windows XP Professional for corporate use, or Windows XP Home Edition for home users.

workgroup: In *Windows NT*, *Windows 2000*, *Windows XP*, or *Windows Server 2003*, a workgroup consists of one or more computers that do not participate in a *domain* and are therefore responsible for their own security and administration.

workstation: A computer that has been set up for use by an individual typically connected to a *network*. The term is also used to indicate a *client* computer, in contrast with a *server*.

x86: Symbol to represent a series of *CPU*s, manufactured by *Intel* and others, including model numbers 8086, 80286, 80386, 80486 and 80586 (*Pentium*). All of the CPUs in this series have certain characteristics in common, which permits *software* to be written that will run on any of them.

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